DISCOVERY

A MONTHLY POPULAR JOURNAL OF KNOWLEDGE

EDITED BY EDWARD LIVEING, B.A.
SCIENTIFIC ADVISER: A. S. RUSSELL, D.Sc.

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Vol. III, No. 33. SEPTEMBER 1922. PRICE 1s. NET
(Annual Subscription, 12s. 6d. Post Free).

THE MAN WHO DESIGNED ST. PAUL'S.
The famous bust of Christopher Wren by his contemporary, Edward Pierce.

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JOHN MURRAY, 50a, ALBEMARLE STREET, LONDON, W.1.

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Edited by EDWARD LIVEING, B.A., Rothersthorpe, Northampton, to whom all Editorial Communications should be addressed. (Dr. A. S. RUSSELL continues to act as Scientific Adviser.)

Published by JOHN MURRAY, 50A, Albemarle Street, London, W.1, to whom all Business Communications should be addressed.

Advertisement Office: 34, Ludgate Chambers, 32, Ludgate Hill, London, E.C.4.

Annual Subscription, 12*s.* 6*d.* post free; single numbers, 1*s.* net; postage, 2*d.*

Binding cases for Vol. II, 1921, are now ready. Price 2*s.* 6*d.* net each; postage, 9*d.*

Editorial Notes

THE highest mountain in the world still remains undefeated. This is not for want of daring and endurance on the part of its attackers, or of highly efficient arrangements on the part of their supporters. Captain Bruce and Captain Finch got to a point 1,800 feet from the summit. This in itself was a great achievement. We mentioned a few of the difficulties that beset the climber of Everest's final 6,000 feet in these notes last April. In our November number that well-known explorer, Dr. Rudmose Brown, will explain these difficulties in fuller detail, and will give a general account of the work of the expedition. Meanwhile we must take up the cudgels once more against those people who continue to insist that these expeditions are mere "suicide clubs."

* * * * *

This year they have rather strong ground for defending their ideas on the subject, in that several members of the carrying party perished in the return from the second assault. At once they were able to turn round and say, "There you are. We told you that a disaster would befall this sort of undertaking. Do you really consider this loss of life worth while in an attempt to attain to what is an entirely useless object?" Superficially their objections seem well merited. The most useful gains to knowledge resulting from these two expeditions have been brought back not from the higher altitudes of Everest, but from its lower slopes and surrounding country, which have been mapped out by surveyors, and explored by botanists and geologists. It is not very likely that the men who reach the summit will find a new type of rock, or observe a new star. No; the work that is most apparently useful is done below, and it could be done without anyone ascending beyond 20,000 feet at the most.

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All this is exceedingly rational, a sound piece of "common sense." But the queer characteristic of "common-sense" notions and "common-sense" persons is that they rarely achieve anything important in life. But, to extend these arguments, why play tennis or cricket? You may beat your opponents, but, even if you do, you have made no material gain and, incidentally, you have run the risk of being hit over the head with a racket up at the net, or of losing the sight of an eye from a fast ball. What the whole matter comes to is this: "Never take any risks unless you are pretty certain that they may bring you some material gain." Admittedly, this is a crude presentation of these people's point of view, but we will look at it from both a deeper and broader angle. Months ago we maintained in our [1]columns that "every conquest of our surroundings is a step forward in the upward march of humanity. It may lead to great developments. Of course, it may not. . . . . All the discoveries of modern science are based on the patient work of those who have laboured to discover the secrets of Nature without caring twopence whether or not they were of 'practical value.'"

* * * * *

The growth of civilisation has gradually and largely freed us from the necessity of a continuous effort to preserve our physical welfare, and has allowed the instincts and energy, hitherto devoted to these

[1] DISCOVERY. Editorial Notes, Vol. II., No. 16.

materialistic pursuits, to develop in other directions. Men have unfortunately grown accustomed to think of civilisation as standing for the watchword of "Efficiency." This is true enough, but it is not the whole truth. We venture to think that no one who believes in evolution, in the idea that some gradual process is being worked out amongst mankind, as in every branch and portion of life and matter in the universe, can think of civilisation merely in these terms. The highest result of civilisation seems to us to lie in the fact that it is lifting mankind from the position merely of maintaining life on this particular planet into a position of using that life for higher ends, such as the study of itself and the universe which surrounds it, or of the development of the faculty of appreciating beauty. The knowledge that astronomers have acquired about the peculiarities of certain stars will probably not increase our efficiency or our material comfort; the development of the decoration of pottery did not make eating or drinking easier; and the only material uses of music and poetry, of which one can think, lie in their capacity for soothing troubled nerves, though they could not even be so used except in the case of persons with some considerable æsthetic faculty.

* * * * *

In general we may say that civilisation has resulted in an endeavour on the part of mankind to expand outwards, often with a risk to individual members of the race. All this seems a far cry from Mount Everest. But if we view the attempts to conquer Everest, or the conquest of the North and South Poles, in the light of the preceding considerations, we cannot but see in them a few of the more obvious proofs of that collective urge, that *élan vital,* which is ever driving us forward. Whither we are being driven we cannot humanly say. The urge is there, and to trust to it is, we think, the only possible and the only satisfactory course.

* * * * *

This month, from the 6th to the 13th, the British Association will visit Hull for its annual meeting. The President, Sir Charles Sherington, is by an uncommon coincidence also President of the Royal Society. This has happened only twice before: in 1848 to the Marquess of Northampton, and in 1893 to Lord Lister. The programme, like all British Association programmes, is exceedingly interesting. The social interest of Hull as a great fishing centre will receive prominent attention in a series of sectional discussions dealing with the North Sea. Thus there will be joint discussions on the geological history of the North Sea basin, on biology and fisheries of the North Sea, on land reclamation on the East Coast, and on tides with special reference to the North Sea. Historians tell us that it is probable that the herring came into the North Sea from the Baltic and elsewhere in comparatively recent times. We hope that, as a consequence of this considerable discussion on them and their surroundings, they will not take it into their heads to quit.

* * * * *

The subjects of the evening discourses, which rank in importance next after the presidential address, were mentioned in a review which appeared in this journal last month. This year there will be four Citizens Lectures on the lines of those started by Huxley and Tyndall in the "Sixties." Dr. E. H. Griffith, F.R.S., will speak on "The Conservation and Dissipation of Energy"; Sir Westcott Abell on the "Story of the Ship"; Dr. Smith Woodward on the "Ancestors of Man"; and Professor Coleman, of Toronto, on "Labrador." There will also be special lectures for children by Professor H. H. Turner on "The Telescope and what it tells us," by Professor J. Arthur Thomson on "Creatures of the Sea," and by Mr. F. Debenham, the explorer, on "The Antarctic." With sectional addresses and sectional discussions for specialists, evening lectures and joint discussions for those who are learned but not necessarily specialists, lectures for citizens, and lectures for children, in addition to social meetings, visits, excursions and the like, it is plain that all classes who care anything at all about science and who betake themselves to Hull, are being very amply catered for. In addition, a special effort is being made this year to attract the younger generation of students, and the generosity of a former president of the Association has enabled a certain number of the younger graduates of our different universities and university colleges to be entertained as guests during the meeting.

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The mathematicians, economists, and agriculturists are holding a discussion on economic periodicity, and will in particular discuss Sir Wm. Beveridge's theory that a bad time in trade will be coming in a few years; the chemists and botanists will discuss recent research on photo-synthesis, especially the action of light in effecting the synthesis of bodies like starch and sugar from very simple compounds; the zoologists and the botanists will discuss the present position of Darwinism; the agriculturists and the economists, the possibility of increasing the food supply of Great Britain; and the psychologists and the educationists, the relation of psycho-analysis to the School. These are some of the leading joint-discussions.

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On looking over the subjects chosen by the sectional presidents for their addresses we notice two features

clearly—one, what an extraordinarily broad field the activities of the Association now cover; and the other, how wide is the application of science to the problems of present-day life. No less than eight of these thirteen addresses refer to man and problems of his every-day life; and, of the other five, three alone may be properly accounted academic. This trend towards the application of science to life is a remarkable one. It was not ever thus. Long ago science and her exponents did not worry about this application, and the legend about the professor at one of our ancient universities who, after a laborious life devoted to very intricate research, thanked God he had never done anything that was or would be of use to anybody, although a legend only, puts this fact in an easily remembered form. But to-day the temper is different. "I do not believe in science for the sake of science," said Professor Karl Pearson recently, "but only in its application to man. Thought and learning are of little value unless they are translated into action." As we have already indicated in these notes, we do not agree with this point of view, and we think that the moderate man will prefer a position somewhere between the two extremes.

* * * * *

We wonder what the men who composed the British Association seventy years ago, when it paid a former visit to Hull, would think of the views of those composing it to-day. They would be astonished by many of these, and aghast at some; astonished chiefly at views which have come from the widening of science, aghast chiefly at those resulting from the application of science to man. Thus they would be astonished at Principal Irvine's address on research problems in the sugar groups, or at Sir Richard Gregory's paper on educational and social science, still more at Mr. Peake's address on the study of man. But what would they think of the presidential address to the Geography section, "Human Geography: First Principles and some Applications"; or of that to the Agriculture section, "The proper position of the Landowner in relation to the Agricultural Industry"; or of that to the Economics section, "Equal pay to men and women for equal work"? What is human geography, they would like to know? And what is this nonsense about men sharing rights with masters, or about men and women being paid equally? Professor Hudson Beare's address to the Engineering section on "Railway problems in Australia," could not have been delivered in 1852 unless perhaps the professor was some kind of Jules Verne person. For Australia had no railway problems then; she had no railways. We have travelled a great deal along many roads since 1852.

Impressions of Greenland's Plant Life

By A. C. Seward, Sc.D., F.R.S., Pres. G.S.

Master of Downing College and Professor of Botany in the University of Cambridge

LAST summer it was my privilege to spend three months in West Greenland (lat. 69° N.—71° N.) collecting fossil and living plants and rocks. Mr. R. E. Holttum, of St. John's College, Cambridge, accompanied me as Research Assistant; in the course of two motor-boat journeys of about 600 miles we visited several localities on Disko Island and the Nugssuak peninsula to the north of Disko Island, also Upernivik Island, Hare Island, and other places. Three weeks were spent at the Danish Arctic Station at Godhavn, Disko Island, where we received invaluable assistance from Mr. Morten Porsild, the Director of the Station, one of whose sons was our companion on the motor-boat.

A visit to Greenland in the summer affords a very incomplete idea of a country which is usually associated in one's mind with its winter aspect when, except in the more southern districts, the kayak is replaced by the sledge and all communication with the outer world is suspended. The Greenlander's kayak, a long, narrow, canoe-like boat, was aptly described by the late Sir Clements Markham as "the most perfect application of art and ingenuity to the pursuit of necessaries of life within the Arctic Circle." The isolation of Greenland has compensations. A Danish friend who passes the winter there told me that he watches the last ship leave in September with a sense of relief; it means at least six months of peace and quiet. A few brief descriptions of typical scenes may serve to dispel the popular fallacy that even in the summer this Arctic land offers few attractions as a place of residence. John Davis in the latter part of the sixteenth century described Greenland as a land of desolation, and added: "The irksome noise of the ice and the loathsome view of the shore bred strange conceits among us." Shelley's lines:

> "From the most gloomy glens
> Of Greenland's sunless clime,"

though applicable to certain localities in the winter, do scant justice to Greenland in summer.

The abundance of flowers makes an unexpected impression upon a visitor imbued with the idea of a country practically buried under a mass of ice of unknown depth, and of a long winter when the sea is frozen and even the coastal regions are covered with snow. One effect of Arctic conditions is to limit the production of foliage shoots and often to induce an abnormal development of subterranean stems and roots and a prolific crop of flowers. The amount of energy expended in the production of roots becomes

apparent if an attempt is made to dig up intact a fairly large prostrate Willow. The rocky ground is generally covered with a thin layer of soil and roots are unable to grow far in a vertical direction. In some places permanently frozen ground is met with at about two feet below the surface, while in other situations there may be at least two yards of unfrozen earth or sand in the summer. The root of one Willow we dug up was traced for at least twelve yards, growing horizontally not many inches underground. Size is a misleading criterion of age; the wood of a Willow stem barely an inch in diameter may show as many as 100 attenuated annual rings. In the districts we visited Willows, including the British species, *Salix herbacea* (the smallest tree in the British Isles) and a few other species, with many hybrids, and the dwarf Birch are the only trees. The tallest examples growing in sheltered places or against the sides of rocks reach a height of two to three feet; for the most part they lie prone on

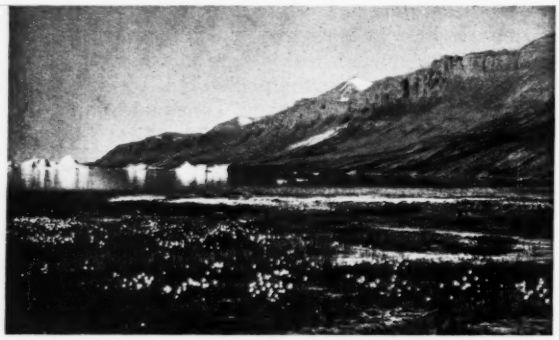

FIG. 1.—PART OF A DELTA WITH COTTON GRASS AND OTHER PLANTS.
[R. E. HOLTTUM, *photo.*

the ground with no main stem but spreading and often twisted shoots in which the annual increase in length is very small. In South Greenland, on the other hand, trees are more abundant and much higher; in rare instances they reach a height of about eighteen feet. In addition to Willows and Birches there are Junipers, Alders, and the American Sorb (*Sorbus americana*).

Landing on a beach where glacial streams have built up a fan-shaped delta sloping seawards in a graceful curve from the mouth of a ravine cut by successive spring floods through the rocks of the raised plateau, one finds stretches of muddy flats and boggy ground covered with the waving white plumes of the Cotton grass and many other familiar plants (Fig. 1); on the drier ground are bright reddish-purple patches of a handsome Willowherb closely allied to our common British species, and clumps of bright Poppies and darker and more brilliant Dandelions. In both wet and dry situations the bright green feathery stems of the common Horsetail flourish in quantity. The hill sides are often clothed with a thick carpet of heath-forming vegetation mixed with stunted Willows; the leaves of some of the Willows are covered with a silvery down forming an attractive background to the dark red catkins. Trailing branches of the Dwarf Birch, parti-coloured tangles of Lichens, Mosses in different shades of green, and creeping or erect Club Mosses are characteristic features. Among the common heath plants are the Bilberry, which in the latter part of the summer provides an abundance of fruits dusted with a blue-grey bloom, the Crowberry, a Rhododendron resembling the Alpine Rose, a species of Ledum—sometimes called Labrador tea—a plant of American origin with dense and fragrant clusters of star-like flowers, Phyllodoce, characteristic of high northern latitudes, and found also in the Pyrenees but not on the Swiss Alps, with its purple bells recalling those of our Heaths, and an abundance of the beautiful white flowers of Diapensia, a genus with a wide distribution from Spitsbergen through Grinnel Land to Eastern Canada and the United States and Japan, two species of a widely spread American and Siberian genus Cassiope, the commonest of which, *Cassiope tetragonia,* has small crowded leaves like green overlapping scales grasping the slender stems in four regular geometrical rows with here and there a white bell pendulous on a delicate stalk. One of the most abundant and attractive plants is *Pyrola grandiflora,* a species unknown in Britain but represented in our flora by its near relative the Winter Green; from a rosette of glossy dark brown leaves the flowering shoot stands erect bearing a series of wide-open flowers with pinkish white petals. The yellow and pale pink flowers of Pedicularis (the genus which includes the Lousewort), crowded on stout stems with rich brown leaves, add to the variety of colour. A species of Dryas, *Dryas integrifolia,* very similar to the British Alpine species *Dryas octopetala,* is exceedingly common. The pure white flowers and slender grey-green stems of the Alpine Cerastium (the Alpine Mouse-eared Chickweed), the viviparous Polygonum, its tall spikes with terminal flowers overtopping most of its neighbours, groups of blue Harebells, and on the sandy beaches the darker sky-blue flowers of Mertensia, several different kinds of Saxifrage, species with shining white flowers on long stalks and the more compact cushions of *Saxifraga oppositifolia* with a rich display of purple-blue flowers; species of Ranunculus and Potentilla and an attractive little Draba allied to the white Vernal Whitlow grass with yellow and white flowers; clumps of yellow Dandelions and Arnicas; these with many other less showy plants, in which brown is the dominant shade, all have a share in the general scheme of colour.

Many of the Greenland flowers are familiar British or European species; others come from the New World; botanically as well as geologically Greenland has many features in common with both the eastern and western hemisphere. It is a noteworthy fact that among the flowering plants recorded from the country as a whole, about four hundred, only one or two are peculiar to Greenland. On rocky slopes, often tucked away in crevices, the cushions of the Moss Campion (*Silene acaulis*), anchored by a strong tap root like an elongated rat's tail burrowing far into the covering of earth, represent a well-known architectural type in Alpine and Arctic countries.

In the neighbourhood of Godhavn, especially in the exceptionally favourable locality known as Englishman's Harbour, so called because an English Captain mistook it for the main harbour and wrecked his ship there, the abundance of southern types is a striking feature. The sheltered bay faces south, and has the added advantage given by the warm springs, reminiscent of the days of volcanic activity in this part of Greenland, which issue along the irregular boundary between the old granitic foundation rocks and the much more modern superstructure of basalt and beds of ash. Here can be seen in profusion, in company with a host of other plants, yard-high stems of Archangelica clasped by the large and handsome leaves and bearing candelabra-like umbels of small yellow-green flowers, a plant familiar to us from its use as a sweetmeat and highly prized by the Eskimo as an article of food; also the large and almost circular bright green leaves, four inches or more in breadth, and inconspicuous flowers of a northern species closely related to our Lady's Mantel; the tall flowering spikes of the Orchid Habenaria (Fig. 2), akin to the Frog Orchis of Britain; also smaller plants of the Tway Blade Orchis, and the delicate mauve tasselled flowers of an Alpine Meadow Rue. The Butterwort (Pinguicula) was found in full bloom in the boggy ground. A few Ferns mix their graceful fronds with the foliage of the flowering plants, and other, generally smaller ferns, pass their life hanging on the vertical faces or in the fissures of rocks. The occurrence at Englishman's Harbour and at other localities on Disko Island of plants characteristic of the more southern parts of Greenland is consistent with an Eskimo legend, according to which Disko Island once lay much farther south. In its original home the island was a hindrance to navigation, and an Eskimo Sorcerer towed it behind his kayak to its present situation.

Despite the shortness of the season and the hard conditions inseparable from an Arctic climate, the vegetation competes successfully in the show it makes with that of warmer countries, and is in some respects superior. How, it may be asked, does the vegetation of Greenland compare with that of the tropics? Sunlight, air, and water are everywhere the driving forces of the living plant. In Arctic lands cold and dry winds and winter snow set limits to the upward growth of shoots and compel them to hug the ground and to exercise a strict economy in the production of vertical stems. A large proportion of the energy available is expended upon the formation of reproductive organs. Tropical conditions induce length of stem and leaves on a lavish scale, the formation of dense jungles in which the competing trees make every effort to obtain a place in the sun. By comparison with the variegated carpet of flowers that

FIG. 2.—ORCHIDS, POLYGONUM, DANDELIONS, FERNS, ETC. ENGLISHMAN'S HARBOUR.
[R. E. HOLTTUM, *photo.*

brightens an Arctic landscape, the ground in a tropical forest is intensely gloomy; the flowering shoots of climbers are festooned over the branches of crowded trees often blossoming far above the reach of man or even beyond his vision, while the smaller plants pass their life attached to the sunlit boughs of supporting trees in the topmost region of the jungle. Arctic conditions demand a concentration of effort, and the result is a " rush of flowers " when once the winter is passed. Timely preparation is

made during the growing season which ensures a prompt response to the first call of spring; buds are ready by the end of summer; in the winter they find shelter under the snow or below a covering of dead leaves. It is an interesting fact that annuals are very rare in Greenland, only four or five flowering plants complete their life-cycle in one season. In the Swiss Alps the percentage of annuals falls as higher altitudes are reached.

While it is true that many of the Greenland plants exhibit a characteristic and peculiar habit of growth and certain external characters and structural features in their foliage and stems that are usually considered to be adaptations to rigorous climatic conditions, others are in no visible respect different from plants that flourish in a warmer and much more favourable environment. The power to endure hardship probably resides in some quality of constitution, something that is fundamental in the composition of their "physical basis of life," the living protoplasm.

The high northern distribution and the abundance of flowering plants in the Arctic regions are in striking contrast to their absence in corresponding latitudes in the southern hemisphere. The North Pole is surrounded by the Polar Sea bounded by a ring of circumpolar lands; the South Pole is situated on a vast continent separated from the nearest land masses by the turbulent Southern Ocean with scattered archipelagoes and solitary islands, some of which are of comparatively recent origin, while others may be vestiges of submerged connecting bridges. Not a single flowering plant has been discovered within the Antarctic Circle. The most southerly representative of the flowering plants, over four hundred of which occur in Greenland, is a grass (*Deschampia antarctica*) which was found in the sub-antarctic region, and reaches its southern limit at latitude 62° S., a position corresponding to that of the Faroe Islands and the south of Finland in the northern hemisphere.

The fringe of Greenland where the snow and ice, like winter clothes, are discarded as soon as the freezing-point is passed, becomes in the more favoured situations a paradise of flowers not equal in brilliance to Alpine meadows at their best, but characterised by a harmony of colour in keeping with the sombre grandeur of the setting. The barrenness of wind-swept slopes, that on the melting of the snow are scarred by destroying streams leaving in their track patches of withered shoots pressed against the ground and dead dishevelled Willows anchored by bared roots, like cables dragged taut by the strain of rushing water (Fig. 3), intensifies that impression of sharp contrasts that a Greenland landscape produces. Charles Lamb's contemptuous description of seashore vegetation in "The Old Margate Hoy" essay is applicable to some parts of an Arctic land:—"I hate those scrubbed shoots, thrusting out their starved foliage from between the horrid fissures of dusty innutritious rocks, which the amateur calls verdure, to the edge of the sea." But in the scrubbed shoots of the Willows and the Dwarf Birch, with their profusion of catkins doomed by the force of circumstances to lead a prostrate life on bare rock, on the faces of cliffs, or creeping among a miniature undergrowth of Moss, Lichen, and other plants, there is a beauty that arrests attention; and in the late summer, when the green leaves have turned to light orange or brilliant red, and the Willow catkins are covered with open capsules releasing the white fluffy seeds, the ground becomes a mosaic of colour that it would be difficult to match in many more favoured lands.

The influence of Lichens as factors concerned with colour production in Nature is well illustrated in many parts of Greenland. At the small Settlement of

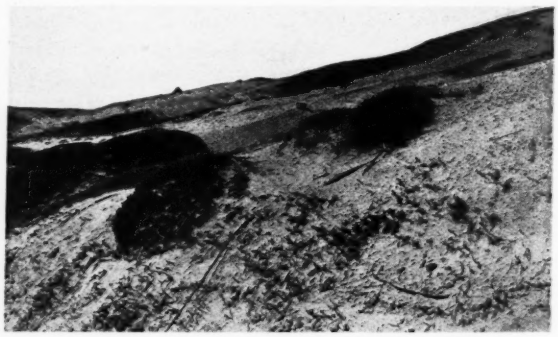

FIG. 3.—WILLOWS ON SANDY SLOPE WITH EXPOSED ROOTS.
[R. E. HOLTTUM, *photo.*

Niakornat the huts of the natives are built close to the beach or perched on ledges on the higher ground. Seen from a distance the massive and partially rounded though rugged boulders and hills of volcanic breccia—a rock composed of angular pieces of a fine-grained and in part glassy lava embedded in a matrix of volcanic ash—produce a particularly gloomy impression by the contrast of their dark shoulders to the lighter hills near them; but on a nearer view the dark surfaces are seen to be almost covered with splashes of a vermilion Lichen. It is not improbable that in the menacing headlands that guard the harbour of Niakornat and partially encircle the Settlement we have the relics of a vast accumulated mass of ash and splintered rocks ejected from some old volcano in the immediate neighbourhood. The peculiar construction of Lichens renders them less dependent than other plants upon the nature of the substratum on which they grow. As films of dull black they dapple the grey surfaces of granitic rocks while other species produce a harmony of orange, yellow, and grey. On stony ground among bosses of

protruding rock, and mixed with prostrate or tufted shrubs of the heath vegetation, large cushions of grey Lichens that when dry crumble to the touch, the flat deeply lobed surfaces of a bright yellow species, and the clumps of erect branches of stouter forms sometimes tipped with small scarlet balls, give light and brightness to the duller background.

The vegetation of Greenland is intensely interesting to the botanist, not only because of the richness of the flora, but from the point of view of its past history, the relation of the vegetation of to-day to that which preceded the Glacial period, and the routes by which the pioneers of the present plant population arrived. There is a certain emotional influence produced by the heath-covered hill sides and swampy lowlands, by the scattered colonies of more brilliant flowers on the drier rock-strewn regions of this treeless land for the perception of which no knowledge of Natural Science is needed, and even the layman's sense of wonder is stirred when he considers what this display signifies as a triumph of the forces of life over adverse physical conditions.

NOTE.—For a more technical and more complete account of the vegetation of West Greenland, and for references to literature, see R. E. Holttum, *The Journal of Ecology*, Vol. X., No. 1, May, 1922.

Honey that Drove Men Mad

By W. R. Halliday, B.A., B.Litt.

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IN the Near East honey is still used as the chief constituent of most of the somewhat cloying sweetmeats which are dear to Turkish palates. In the ancient world it was not merely a luxury but a necessity, filling, as it did, the place of sugar in modern life. It was consequently an important article of commerce and bee-farming was a serious branch of profitable husbandry. That is the reason why Vergil, for instance, devoted one of his four *Georgics* to bees. His choice was not merely due to the desire to draw the moral of the analogy between human society and that of the hive, which has been a popular topic with poets and preachers in all ages.

In Illyria mead was manufactured from honey. But like beer, which was also known to the Greeks and Romans,[1] mead never became popular in the essentially wine-drinking countries of the Mediterranean, though honey was used for softening and sweetening wine. In mythology (I do not know of an historical instance) there is an example of smearing a criminal with honey and exposing him to the consequent torture of flies; and the ancient Greek analogue to *The Mistletoe Bough* tells how Glaucus, the son of the King of Crete, when chasing a mouse fell into a large jar of honey and was lost. He was, however, more fortunate than the bride in the English song, for when he disappeared there happened to be at hand a famous "wise man" from overseas, Polyidos of Argos. He was called in, discovered the boy's fate, and was then informed that he must take steps to restore him to life, and that he would be shut up in the tomb with the dead body until he was successful. While thus immured Polyidos killed a snake, whereupon its consort brought a leaf of a herb in its mouth, laid it on the wound and restored it to life. The seer watched this proceeding with interest, procured a leaf of the magic herb, and brought the boy to life again. The king, however, was not yet satisfied and refused to let the prophet leave his dominions until he had taught Glaucus his magical lore. This Polyidos was obliged to do, but, as at length he left the shore of Crete, he bade his pupil spit into his mouth. Glaucus did so, and the magical knowledge which he had acquired left him and returned to its imparter.[1]

It has been thought that the story of Glaucus falling into the honey-pot may have some connection with early burial custom. Both Babylonians and Persians used beeswax as a preservative for corpses.[2] It may have been from the East that the Greeks learned this use of it. Special importance was attached at Sparta to the funeral rites of their kings, and if the body of a king for any reason could not be brought to Sparta, the rites were carried out with an effigy of the corpse. At least, in one historical instance, that of Agesilaus, in the middle of the fourth century B.C., the body of a king who died abroad was embalmed in beeswax and so brought home for burial.

From the earliest times honey, milk and wine formed the triple offering to the dead, and although the worship of "heroes" (*i.e.*, the spirits of dead men of legendary or historical importance), seems to have become a prominent feature of Greek religion only in post-Homeric times, the author of the eleventh book

[1] The attitude of Greeks and Romans towards beer finds its expression in the well-known epigram of Julian the Apostate. "Who and whence art thou, Dionysus? For, by the true Bacchus, I know thee not; I know only the son of Zeus. He smells of nectar, but thou of billy-goat. Did the Celts for lack of grapes make thee out of corn?" Anth. Pal. VI., 368 in *The Greek Anthology* translated by W. R. Paton (Loeb Classical Library) III., p. 201.

[1] The story is made up of folktale elements. There are classical variants of the snakes and the healing herb, *e.g.*, the story of Tylo, Pliny, *Natural History*, XXV., 5 and the tale told of Alexander the Great and Ptolemy, Cicero, *de div.*, II., 66, 13. References to variants will be found in Bolte and Polivka, *Anmerkungen zu den Kinder und Hausmärchen der Brüder Grimm* (Leipzig, 1913), I., pp. 128-129. For the way in which Polyidos deprived Glaucus of the magical knowledge which he had acquired see *ibid.* p. 133.

[2] Herodotus, I., 140 and 198.

of the *Odyssey*, which describes Odysseus' visit to the nether world, had clearly visited an oracular shrine of a hero. His description of the ritual with its triple libation of honey mixed with milk, sweet wine and water,[1] exactly corresponds with what is known to have been the rule in such ceremonies in historical times. Thus, for example, Iphigenia performs the funeral rite :—

> O Spirit, thou unknown
> Who bearest on dark wings
> My brother, my one, my own,
> I bear drink-offerings
> And the cup that bringeth ease
> Flowing through Earth's deep breast;
> Milk of the mountain kine,
> The hallowed gleam of wine,
> The toil of murmuring bees;
> By these shall the dead have rest.[2]

The living made their cakes and sweetmeats of honey and the varieties produced in different localities were distinguished by the connoisseur. The honey of Attica was already famous in the time of Solon (594 B.C.) and throughout antiquity it maintained a special reputation. Its excellence was attributed in part to the thyme which grew upon Mt. Hymettus, and attempts were even made to produce the same honey elsewhere by transplanting Hymettan thyme. It was thought, too, that the method of the Athenian beekeepers, who took the honey without smoking out the bees, in this way contributed to the purity of its flavour.

Honey, in fact, was eaten in all parts of the ancient world, and the peculiarities of the various kinds were well-known. If, therefore, the properties of the honey of a particular district excited surprise as something quite exceptional, we shall probably be right in assuming that it was peculiar to its particular part of the area known to the ancient world. Various kinds of honey were known which were unpleasant to the taste or deleterious in their effects. There was, for example, a Mauretanian honey which was unwholesome, and the Sardinian, thanks to the proverbial bitterness of the local variety of *apiastrum*,[3] a kind of wild parsley, possessed a bitter after-taste. But the honey produced in the south-east corner of the Black Sea, in the district which lies between Trebizond and Erzerum, stands quite by itself. The honey of Heracleia Pontica further to the west was in certain seasons deleterious, but the symptoms produced in the victim, who rolled upon the ground in an agonised sensation of extreme heat, seem to have differed from those caused by the honey of Trebizond. Colchis, further to the north, round the coast of the Black Sea, has also fallen under suspicion of producing "maddening" honey. Tournefort quotes some second-hand information to that effect, which I suspect, however, of being inexact. Strabo knew that Colchian honey was bitter, and Evliyá Effendi warned people against eating it, but for a different reason.[1] So far as my acquaintance with the works of classical authors and of more recent travellers extends, the "maddening" honey, as it was called, is restricted to the Trebizond-Erzerum area.

Its properties were first made known to the Greek world through the involuntary experiment of Xenophon's Ten Thousand. After the death of the Pretender to the Persian throne, by whom they had been engaged, they had fought their adventurous way from the heart of Mesopotamia through unexplored country and savage peoples to the sea. They had almost reached Trebizond when the adventure of the honey occurred. Those who ate of it were affected according to the quantity consumed. The mildest symptoms were those of intoxication; those who had eaten a considerable quantity were like madmen, and those who had eaten largely became insensible. None of these died, but recovered consciousness in almost exactly 24 hours, though it was two or three days before they were themselves again.[2]

This maddening honey was naturally discussed in antiquity, and the cause of its properties was attributed to the nature of plants in the district from which the bees collected nectar. It puzzled Pliny that the character of the honey both at Trebizond and at Heracleia varied in different years, and the latter, it was noticed, was peculiarly liable to be poisonous when the spring was abnormally wet.

Grote, who accuses *Azalea Pontica* of responsibilty, rightly rejected the scepticism of a German named Koch, who, because he did not himself meet with poisonous honey in Pontus, thought that Xenophon's men must have eaten honey which had gone bad with keeping.[3] The ancient authors too are confirmed by the experience of a Turkish traveller in the seventeenth century, who had not read Xenophon. At the fortress of Hassan, in the province of Erzerum, Evliyá remarks, "bread and honey are rather to be suspected, for I myself, poor Evliyá, having eaten

[1] Homer, *Odyssey*, XI., 27. Butcher and Lang are mistaken in translating μελικρήτῳ "mead."

[2] Euripides, *Iphigenia in Tauris*, 156, translated by Gilbert Murray.

[3] Vergil, *Eclogue*, VII., 41.

[1] Strabo, XI., 2, 17, c. 498, Von Hammer, *The Travels of Evilyà Efendi*, II., p. 56. "These Abaza people have a strange mode of burying their Begs: they put the body into a wooden coffin, which they nail on to the branches of some high tree and make a hole in the coffin near the head, that the Beg, as they say, may look up to Heaven: bees enter the coffin and make honey, entirely wrapping the body up in it; when the season comes they open the coffin, take the honey and sell it: much caution, therefore, is required to be used in purchasing the honey of the Abazas."

[2] Xenophon, *Anabasis*, IV., viii., 20 foll. Translation in Dakyns, *The Works of Xenophon*.

[3] Grote, *History of Greece*, IX., p. 155.

some honey in the commander's house, became in half-an-hour so giddy that I thought of throwing myself down from the castle."[1] The French botanist and traveller Tournefort, in the eighteenth century, was of course familiar with the classics, and discusses the relevant passages in Xenophon, Pliny and Dioscorides. He attributes the origin of the poisoned honey to two different species of rhododendron, and evidently in the case of one of them local popular belief was with him; for when he intended to present a bouquet of its flowers to the pasha, in whose suite he was travelling, he was informed that their perfume caused headaches and was deleterious to the brain.[2]

My friend and colleague, Professor McLean Thompson, has been kind enough to give me some information which, although perhaps familiar to botanists, is evidently unknown to most readers and to the commentators on Xenophon; other persons, who are as ignorant as myself in such matters, may also find it interesting. Nothing, he tells me, can be found in the flowering records which can be used as evidence against any of the species of plants, which are quoted by the various authorities, to prove that they are naturally poisonous, nor is anything known of the Black Sea littoral which provides a basis for the idea that climate determined the poisonous nature of the honey. There are, in fact, no grounds for supposing that there is anything poisonous in the honey itself provided that it is collected normally by a nectar collecting insect. "But honey is almost invariably a lost product, produced in excess at a point in the flower where food materials should be used in forming floral parts. The latter fail to develop, the food materials are unused, and are exuded on what are in a sense the graves of the aborted parts. With this almost invariably there goes the development of succulent deformed mounds of tissue, replacing the perverted parts, and in these parts there is abnormal physiology and frequently the accumulation of by-products in which toxins abound. Now I can testify that in the cases you mention surface collecting of nectar is the rule, and this involves no risk of poisoning the nectar. But in seasons, when the competition for nectar pollen is intense, many insect types adopt a biting habit, piercing the tissues of many plants of different type, in search of short-cuts to food supply, while other types fail to develop this new habit. I have never known the nectar disc of Heracleum to be pierced and the corolla alone of Azalea is pierced and does not contain poison. Nevertheless, I have known many insects not drunk but completely stupified after a period of flower biting while collecting nectar. From this they recover after periods of from 8 to 24 hours. The inference is that in seasons when the biting habit is common, honey may be poisoned frequently by the toxins of plants which have been bitten. Recently (last year) I knew of so-called poisoned honey in Liége in a season when the biting habit was very common and on asking a beekeeper on the point, he said that in 1893, a year also when the biting habit was common, poisoned honey was known."

This explanation, it will be noticed, solves Pliny's problem, and confirms the accuracy of his observation that the honey was poisonous in some seasons and not in others.

[1] Von Hammer, *Op. cit.*, II., p. 119.

[2] Tournefort, *Relation d'un Voyage du Levant* (Paris, 1717), II., pp. 228 foll.

Galileo, the Roman Inquisition, and Modern Italian Philosophy

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A PLEASING trait in Italian life is the perennial interest Italian citizens take in the spiritual, as well as the patriotic, history of their country. The wealth of literature which this preoccupation with the things of the mind brings to light is remarkable. No community, however small, however remote from centres of population, but which has its patient students. Monographs of this nature abound, often produced at the cost of the renunciation of the more material agreements of life. As in the citizen, so in the State. The new Italy, limited as she is in financial resources, reflects this care for the concerns of the mind. She publishes the works of her thinkers and her artists in monumental national editions, and Royal Commissions have published Mazzini's, Da Vinci's, and Galileo's works. The last, in twenty stately tomes, together with a supplementary volume of documents relating to Galileo's trial at Rome edited by the director of the national edition—documents long buried in the recesses of the Holy Office and in the secret archives of the Vatican[1]—have enabled Professor Gentile to include a collection of Galilean *Frammenti e lettere* in the publications of the *Biblioteca di Classici italiani*.[2] By the aid of these documents and Gentile's admirable notes and comments it is possible to review the story as told in the calm order of the legal procedure.

If we may imagine the symbolic man-in-the-street to be set before a paper, "Write what you know of Galileo," he would probably (if he answered at all)

[1] *Galileo e l'Inquisizione. Documenti.* A. Favaro. Florence.

[2] R. Giusti. Leghorn.

reply that Galileo was an Italian astronomer who taught that the earth was round and not flat; that it circled round the sun instead of being stationary; and that when tortured by the Roman Inquisition and made to recant he muttered between his teeth, "*Eppur si muove.*" Marks would be low, for the good Galileo never was put to the torture, and he never said "*Eppur si muove.*" Nor did the mediæval astronomers teach the earth was flat. I imagine there are but few readers of Dante's *Vita Nuova* nowadays who are not made to sit up when they discover that to understand the reference to Beatrice's age in the very first paragraph, a knowledge of the precession of the equinoxes is necessary—an astronomical phenomenon known to every mediæval student, although regarded from a geocentric standpoint. If there is one thing more than another which distinguishes the modern from the mediæval student, it is his ignorance of practical astronomy—of the apparent motions of the heavenly bodies. If anyone would form a conception of the astronomical knowledge of the mediæval scholar, let him get a sight of the perpetual almanack compiled by Profacius (Machir Ben Tibbon)[1] of the University of Montpellier, in the latter half of the thirteenth century, from which the courses of the moon and planets and their eclipses might be foretold at any given date from 1300 onward. As early as the fourth century, tables and rules were extant by which the days and hours of eclipses were accurately calculated. And if one remembers that such calculations were rendered much more complicated and difficult by being based on a geocentric theory of the universe, one's respect for the precision and range of early astronomy will be tenfold. Pre-Galilean astronomy from the days of Hipparchus to Ptolemy and Alphraganus had been elaborated and perfected during the progress of eighteen centuries; it adequately explained the apparent phenomena and served all practical purposes of civil life—an astronomy rendered almost sacred to the mediæval mind by the infallible authority of Aristotle—an astronomy which Sir Thomas Browne regarded as a proof of God's wisdom, and which Bacon refused to reject in favour of the Galilean theory. Besides its practical uses there was another reason why the mediæval mind was absorbed in the contemplation of the heavenly bodies and their wandering paths, and why the astrologer sought to fathom the sweet influences of the Pleiades—their supposed infallible influence on mortal life and destiny.

How much longer geocentric astronomy would have persisted if a Dutch spectacle-maker's apprentice had not, while playing with some lenses, discovered that by placing two of them at intervals distant objects became nearer, none can tell; but to a young professor of mathematics at Padua the toy became a key to a startling new reading of the heavens.

"In August 1609," writes the Venetian diarist Priuli, "I climbed the campanile of St. Mark with the excellent Galileo and Signor Contarini, to see the marvels of the said Galileo's new tube. Closing one eye and looking through the other each of us saw distinctly Fusina and Chioggia, and even Conegliano, and folk entering and leaving the church at Murano, with many other details truly marvellous to behold." Marvellous and indeed revolutionary! Imagine what would be the feelings of our scientists of to-day if a new discovery were to render obsolete all modern physical science, vitiate our heliocentric astronomy, make all our text-books and professors back numbers: some conception may then be formed of the feelings of the mathematicians of Galileo's time. There is nothing absolute in what is termed scientific truth. Our system is true so long as it satisfactorily explains phenomena as we know them, and that is precisely what the geocentric system did in pre-Copernican days, and did it more satisfactorily than Galileo's new theory. Galileo was a born controversialist, and employed with masterly skill that grave and eloquent irony which Carducci says so splendidly closes the great literature of the sixteenth century. This and his mordant sarcasm were ill calculated to win over opponents. He thus trounces a learned classical senior who quoted Suidas in proof of a theory on the nature of heat—Suidas who stated that the Babylonians used to cook eggs by whirling them quickly in a sling. "Of course, if I am told I *must* believe this I will, but I can't help saying this much. If we don't succeed in producing an effect that was successfully produced in earlier times some element of success must be lacking, and this element must be vital. Now we have eggs and slings and stout fellows to swing them. Yet the eggs don't cook; on the contrary, if they were hot the swinging would more quickly cool them. Therefore, since all that is lacking to us is that we are not Babylonians, it follows that the fact of being Babylonians is the effective cause of the eggs cooking, and not the attrition of the air—which is what I set out to prove." [1]

Contrary to what is generally believed, Galileo was first brought up, not against the Church, but against the mathematicians and Aristotelians—Aristotle who, as students of Dante will know, was authoritative in mediæval schools. If Aristotle said a thing, like *John Bull*, it was so. "I was one day," says Galileo, "at a physician's house at Venice who was giving a lesson in anatomy. Having dissected and traced the nervous system to its origin in the brain, and its extension through the spinal cord and its ramifications through the human body, a sceptical Aristotelian present said, 'You have demonstrated this so clearly to my senses,

[1] Edited and published at Florence in 1908.

[1] *Frammenti*, p. 66.

that if it were not for a text in Aristotle which says the nerves have their origin in the heart I should be forced to admit you were right.' "

Unhappily, Galileo, or his disciples, failed to take the advice of a Roman friend and keep outside the sacristy. All things are lawful, but all things are not expedient, and a letter to Father Castelli, a Benedictine mathematician in 1615, admirable in its distinction between science and the Bible, which passed in many copies from hand to hand, began the trouble. The letter was denounced in February, 1615, by a Dominican rival to Rome, and added theological to mathematical odium. Moreover, another Dominican friar, a month later, deposed on oath to the Holy Office, that preaching against Copernicus one day in the cathedral at Florence, on the text, "Sun, stand thou still upon Gibeon," he had displeased certain petulant disciples of Galileo, known as *Galileisti,* who went about promulgating heretical doctrine. On November 13 a Spanish friar deposed to the local Inquisitor that he too had heard the *Galileisti* say the earth moved round the sun.

On February 24, 1616, eleven Inquisitors met at Rome and decided certain propositions on sun spots were absurd as philosophical propositions, against theological truth, or at least errors in faith, and Cardinal Bellarmine was charged to admonish the said Galileo the mathematician to renounce the opinion that the earth moved round the sun, and wholly to abstain from teaching or defending or treating of it under pain of imprisonment. Galileo, then at Rome, promised obedience, and was received kindly and sympathetically by Pope Paul V., and spent three-quarters of an hour strolling about with the Holy Father, who assured him of his esteem and confidence in his integrity. The year before, Cardinal Bellarmine had written worldly-wise advice to a Carmelite *Galileista,* " You and Galileo would do well to speak *ex suppositione* and not absolutely. If you say supposing the sun stands still and the earth circles round it, the apparent motions of the heavenly bodies *may* be better explained than by the theory of eccentrics, cycles, and epicycles, it is well said; no danger will be incurred. But if you assert that actually the sun *is* the centre of the universe, that is dangerous, and serves not only to irritate the scholastic philosophers, but to injure the Holy Catholic Faith."

Ardent possessors of a new truth are seldom amenable to worldly wisdom, and Galileo continued to explain phenomena on the Copernican theory.

As late as 1630 Galileo counted on the publication at Rome of the famous *Dialogo sopra i due massimi Sistemi del Mondo,* which had received the *Imprimatur,* and in that year he had a long audience with his friend, Cardinal Barberini, now Pope Urban VIII., who enjoined him to preface the work with a statement that the subject was treated as an hypothesis. Urban also advised him to end the Dialogue with an argument which he himself regarded as conclusive against the Copernican theory. After long and tiresome negotiations at Rome, the book was at length published at Florence in 1632—preface and conclusion as enjoined. But—most assuredly the interlocutor who defended the geocentric theory might have done better. Worse than all, the conclusion, the clinching demonstration of the falsity of the Copernican doctrine, was placed in the mouth of Simplicio (Simple), who throughout opposes the most futile arguments which are triumphantly disposed of in Galileo's caustic and facetious manner. Urban was furious. He declared that the Dialogue was more pernicious than the writings of Calvin or Luther. Jesuits and theologians were in ecstasies. They hounded on to the scent, and on September 23, 1632, the congregation of the Holy Office cited Galileo de Galileis, a Florentine, to Rome, and forbade the sale of the book.

Galileo opposed passive resistance, trusting to Grand Ducal influence to change the venue of the trial to Florence, and the local Inquisitor, whose duty it was to send the defendant to Rome, had a most unhappy time. On October 2 Galileo protested he was *prontissimo* to go, and signed on the 9th a document to that effect, witnessed by six ecclesiastics. On November 20 he was ready to set forth, but pleaded advanced age and sickness. A month's grace was given. A month passed and the Inquisitor reports to Rome that Galileo de Galileis was in bed though still *prontissimo*; but times were troublous. Three physicians testified that their patient suffered from an intermittent pulse, vertigo, hypochondriacal melancholy, insomnia, pains wandering about his body, severe hernia, and other troubles. Any slight external cause might imperil his life. An angry rescript from Rome followed. The Holy Office would tolerate these subterfuges no longer. They were sending a special medical commission to report, and if the said Galileo were in a fit condition, he must be brought to Rome, even if a prisoner in irons.

On January 8 the Father Inquisitor read the summons to the recalcitrant Galileo. This time he *was* resolved to obey *quanto prima*; he was *prontissimo* to set forth, and, in fact, after a journey of twenty-one days, did reach the Holy City. On the morrow of his arrival the Assessor of the Inquisition took him for a carriage drive, and with much kindness advised him as to his future conduct. It was an indication, he wrote, that the treatment in store for him was to be *molto mansueto e benigno*—very different from comminations of ropes, chains, and dungeons. During his examination he was received at the Holy Office with *dimostrazioni amorevoli,* assigned comfortable quarters with his body servant

in the handsome official apartments, and allowed much freedom of movement.

Subjected to many examinations, Galileo claimed he had not contravened the Bellarmine admonition of 1616. It was all so long ago. He might have been bidden not to teach the doctrine. He did not remember the phrase *nec docere quovis modo* (not to teach it in any way); it might have been used. He did not admit that he had taught the said opinion; he had confuted it and demonstrated the contrary. This he swore to and signed. On April 30, after close and continual reflection, it had come into his mind to read his book again and diligently to observe if by pure inadvertence something had escaped his pen by which a reader might argue a contravention of the orders of Holy Church. And so reading it as if it were a new work, and by another author, he must confess that in many passages the doctrine was treated in such wise that a reader, unacquainted with his intimate character, might have reason to form a conception that the arguments adduced on the false side (which his intention was to refute) were stated in such a way that their efficacy was potent rather to convince than to refute. His error was one of vanity and pure inadvertence.

After further reflection Galileo asked for another audience. For greater confirmation that he had neither held, nor did hold, as true the damnable opinion of the motion of the earth, he was prepared if time were given, to demonstrate this more clearly. The occasion was opportune since the interlocutors in the Dialogue had agreed to meet again for further discussion. In two or three days, with God's help, he would refute the arguments adduced in favour of the false and damnable opinion in the most effective way. In a further written defence the aged and weary scientist humbly appeals for clemency and kindness, and begs his judges to regard his ill-health and the exposure of his winter journey as ample castigation for his offences.

On June 21 another signed deposition assures his judges that for a long time he had remained indifferent to both opinions; both were disputable. Later, however, all ambiguity was at an end, and he had then held, as he did now hold, that Ptolemy's doctrine was *verissimo* and indubitable; to wit, the stability of the earth and the mobility of the sun. The Dialogue was written, not because he held Copernican views, but to benefit mankind. "I do not hold," concludes the harassed Galileo, "nor have I held this opinion after the order of the Holy Office to let it. As for the rest I am in your hands, do with me as you please." At a final examination he was enjoined to tell the whole truth, and reminded that there was the last resource of torture if he did not. "I am here to do obedience," was the answer. "I have not, as I have said, held this opinion since the decree." Nothing further could be had from him, says the report of the trial, and the sentence was drawn up. On June 22, 1633, in the presence of ten Inquisitors, in the Convent of the Dominican Friars at S. Maria sopra Minerva, the judgment of over a thousand words was read to the kneeling Galileo, who abjured and cursed the errors he was vehemently and justly suspected of. His sentence was, imprisonment during the Pope's pleasure and the obligation to recite weekly the Penitential Psalms.

From the time of his arrival at Rome up to the present, March 7, 1634, he writes to his friend Diodati, from his villa at Arcetri, "he had, thank God, enjoyed better health than for many years past." The first place of incarceration assigned to him was the Tuscan ambassador's beautiful palace and gardens (now the Villa Medici in possession of the French Academy of Fine Arts) on the Pincian, where he was treated affectionately as a son, both by the ambassador and his consort. He was then interned at the Archiepiscopal palace at Siena, where he experienced *inesplicabili eccessi di cortesia* by the prelate, his friend, whose *gentilissima conversazione* he enjoyed with great repose and satisfaction. Growing weary and desirous of change after five months' stay, he was permitted to return to his villa outside Florence, where he breathed the salubrious air of his native place, though forbidden to descend to the city. This to keep him away from the Ducal Court. But if he could not go to the Duke, the Duke could come to him, and for two hours conversed with extreme sweetness. Having suffered nothing in the two things that are esteemed above all others in this world —health and reputation—the injustice that envy and malice had plotted against him neither had troubled, nor would trouble him; absent friends must be content to know this much.

Moreover, at the Convent of S. Martino in Arcetri, the aged and darkening Galileo was in touch with his two daughters by a Paduan mistress, who by papal favour had been permitted to take the veil. The elder and beloved Sister Maria Celeste, *donna di esquisito ingegno*, whose horoscope he had cast, and who idolised her father, was a bright influence in Galileo's life, and her premature death a deep and abiding sorrow. Sweet Sister Maria Celeste, whose tender graceful letters have found a place in the annals of Italian literature, who took upon herself the burden of her father's penance to recite the seven penitential psalms once a week! Throughout the whole correspondence no word of torture, and the facsimiles of his signatures to the depositions, from first to last, show no variation.[1]

Shall we say Galileo lacked courage? That in contrast to the heroism of his predecessor, Giordano Bruno, the proto-martyr of Free Thought, Galileo

[1] *Galileo e l'Inquisizione*, pp. 82, 83, 84, 85, 102.

quailed before the rack and the stake? No. Galileo had steadfastly maintained that the spheres of Science and Faith were separate, that they never intersected, and that there was no need to measure one against the other. Galileo, says Professor Gentile, who certainly cannot be accused of any tenderness to the Roman Inquisition, was the first to recognise that, if ever and whenever the conflict came, science ought to bend as he bent in the cloister of the Minerva. He renounced because his truth was declared incompatible with the doctrines of the Church. The duty of the Church, said Galileo, was to teach men how to go to heaven; not how the heavens go. His position was, that there existed a twofold revelation of divine truth. One positive, absolute, supernatural: the other in continual, progressive formation. One the infallible source of truth and doctrine regarding belief and conduct; the other wholly independent, the domain of scientific research. One deposited in the sacred scriptures and directly inspired by God; the other the fruit of the human mind faithfully reading the book of nature. The importance of his defence of science against the attacks of religious tradition consists in the demonstration of the rights of free scientific research—science by his very definition wholly sundered from those cognitions which theology made dependent on revelation. It differed from theology (which in those days included ethics) in that it had no bearing on the essential aim of the spirit of man, or, as he put it, on the salvation of souls. It was the knowledge of nature conceived mechanically and determined according to quantitative relations, a naturalistic science. But, asks Gentile, does a purely naturalistic science exist?—a science which deals with a reality whose mode of being and operating is indifferent to the soul of man? It was impossible that the theologian of Galileo's time could grasp this absolute separation between the world envisaged by the man of science and that contemplated by the Church—the Church, Catholic and Protestant—concerned with the salvation of men's souls. In the vital question of the day, the Council of Trent, the Tübingen Faculty, the common consent of all the Fathers; all the commentators, Greek and Latin, the millennial traditions of all Christian saints and martyrs, were against Galileo—how could the whole of the Christian Church be indifferent to a revolutionary definition of the world, not merely regarded as the hypothesis of a mathematician, but as existing in *de facto* reality? A world no longer evolved in a scientist's brain, but that very actual state of being which man was a part of, and in which the theologian by divine imposition had laid upon him the awful, the solemn responsibility of guiding man to right moral conduct in this world and to eternal salvation in the world to come. Galileo's imperishable fame rests less on his eminence as a thinker than on his apostolate of the experimental method in natural science. He was a herald of free research, a deliverer of the human mind from the thraldom of Aristotle and the bonds of scholasticism. He saw for the first time that a science of nature might be constituted if it were rigorously separated from metaphysics and based on a direct cognition of facts—facts, not deduced by a process of abstract reasoning, but already before the senses and indecipherable in their intrinsic, essential existence and in their qualitative differences; knowable and measurable only in their quantitative proportions. This science was the result of the experience of the senses, the *esperienza sensata*, and not the product of philosophic ratiocination; a material reality to which those criteria are not referable wherewith man interprets the actions of man and his final destiny.

The value of such a pure science of nature, which the eighteenth and nineteenth centuries applied themselves to, will surely be challenged in our own and in later centuries when the human spirit shall again face, but under a far different aspect, that fundamental problem which Galileo was brought up against—the problem of harmonising naturalistic science, which regards neither the ends nor the needs of spiritual man, nor the laws proper to his spiritual life, with the science that derives from the intuition of man's spiritual need. For the science which men turned to in those centuries with such hope and trust, and which might suffice them when they were engaged in *re*forming minds, prone to a reactionary dogmatism, by a new noviciate—this science no longer satisfies men's minds in which there rises a vague home-sickness for one knows what not beliefs and promises of mysterious satisfactions; for those spiritual and moral needs, which science does not and cannot satisfy, because science is directed to other ends. The new age will therefore demonstrate its limitations.

Sex and its Determination—II

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(*Continued from the August Number, page* 199.)

We have seen in a previous article that the higher animals possess special or sex-chromosomes, two in one sex, one in the other, by whose agency sex is determined.

What must the precise action of this machinery be supposed to be? What, for instance, is its relation to the so-called secondary sexual characters, all those which, like the beard of man, the voice of the nightingale, the plumage of the pheasant, the sexual instincts of many animals, are different in the two

sexes, but not directly concerned with the reproductive organs? Here again, recent research has given us a definite answer. The factors necessary for the development of the characters of both sexes are present in all individuals of any of the higher animals, but normally only those which are proper to one sex actually develop. The presence of one or of two X's acts like a switch, which alters the condition in the developing embryo in such a way that in one case only the male characters can reveal themselves, in the other case the female characters. A female animal contains, locked within the chromosomes of her cells, the factors which in other circumstances could combine to build a male, the male contains, never expressed in reality, the constitution of a female. That this is so is shown definitely by the facts observed when two species are crossed. The males of different species of pheasants, for instance, differ from each other very much in plumage, while the females are all more or less drab and alike. If a female Reeves pheasant is crossed with a male of another race, the males among the hybrid offspring show many characters of the male Reeves pheasant,

FIG. 1.—A FEMINIZED MALE GUINEA PIG ACTING AS SUCKLING FOSTER-MOTHER TO A YOUNG SPECIMEN.

By permission of the Editor of the "Journal of the Royal Society of Arts."
(After Steinach.)

although these characters must have been transmitted through the chromosomes of the mother, in whom they were invisible.

In insects, the simple presence of one or two X's in the cells of the body is enough to call forth the proper sex-characters; but in higher animals like birds and mammals, there is another link in the chain. This link is furnished by the reproductive organs. The sex-chromosome machinery acts as a switch which allows either male or female reproductive organs to develop in the embryo; but as soon as these are developed, they start producing a secretion or hormone which is necessary for the development of all other sexual characters. The most complete proof of this has been afforded by the extraordinary experiments of Steinach, Sand, Moore and others, who have removed the reproductive organs from young rats or guinea-pigs, and grafted into them reproductive organs taken from individuals of the opposite sex. The result has been a complete alteration in the animals' growth, ending in an almost complete assumption of the characters of the opposite sex. Male guinea-pigs whose reproductive organs have been removed and replaced by ovaries have even yielded milk and suckled young in the normal way (see Fig. 1), and show the sexual instincts proper to females. Such animals can, of course, not breed, since at the time of the operation, the internal organs associated with reproduction were already laid down, and only the subsequent growth of the animals was affected. Recently, however, ingenious experiments have been carried out by which developing hens' eggs were opened, and a small piece of reproductive organ from a fowl grafted on to the membrane surrounding the yoke. When the operation was successful, and the chick was of opposite sex to the reproductive organ grafted on to it, the whole development of its reproductive system was affected, and the chicks reached the stage of hatching in a condition intermediate between male and female, often nearly transformed into the opposite sex from that which they by rights should have been.

Very interesting results have also been obtained on adult birds. Here it is found that the ovary secretes some substance which prevents the development of male plumage. A capon, or any male bird with reproductive organs removed, shows no alteration of plumage. But a hen bird whose ovaries are taken out will at the next moult assume the plumage proper to the male. Further, there exist certain breeds of fowls, such as the Sebright bantam, in which the cocks are hen-feathered, and possess none of the special hackles and curved tail-feathers usually seen in cocks. This must be due to their possessing a secretion similar to that of an ordinary hen, for when their reproductive organs are removed, we find, paradoxical as it may seem, that they assume normal male plumage as the result! In insects, as indicated already, removal of the reproductive organs has no effect upon other sex characters.

We next come to certain strange abnormalities which throw considerable light upon our problem. Among insects, curious individuals are found from time to time in which some part of the body—usually a half or a quarter—is male in character, while the rest is female. These are known as *gynandromorphs*. In ants, very remarkable appearances may result. The male ant is winged, the worker female wingless; and thus a gynandromorph may be winged on one side only (see Fig. 2). In the fruit-fly, not only the sex and the secondary sexual characters, but also the sex-linked characters may be different on the two sides. It has recently been shown that the gynandromorphs we have mentioned are really female in constitution, but that at one of the early divisions of the egg, one of the X chromosomes lags behind and fails to get incor-

porated with the rest of the chromosomes. As a consequence, one of the resulting cells still has the proper complement of two X's, while the other has but one. The part with two X's becomes female; that with one, male. If the two X's were carrying

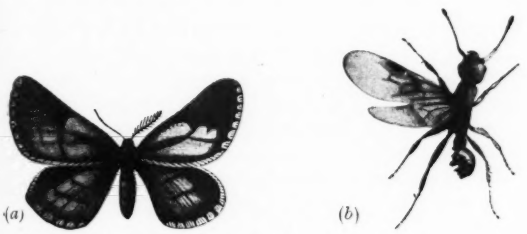

FIG. 2.—GYNANDROMORPHS OR SEX-MOSAICS.

(*a*) Pine moth (*Bupalus pinarius*); female on left, male on right.
(*b*) Ant (*Myrmica scabrinodis*); male on left, worker (sterile female) on right.

Reproduced from "The Determination of Sex," by Prof. L. Doncaster, F.R.S., by permission of the Editors of the "Journal of Genetics" and of the Cambridge University Press.

different sex-linked factors, sex-linked characters also could be different in the two regions of the body. In mammals, these sex-mosaics, as we may call them, do not occur, because the substances secreted by the reproductive organs pass into the circulation, and influence the sexual characters equally all over the body.

An even more remarkable abnormality is provided by what are called intersexes. The gipsy moth, that terrible forest plague, has a well-marked variety in Japan. When this is crossed with the European race, very curious results are obtained. When a Japanese male is crossed with a European female, 50 per cent. of the offspring are normal males, but the remainder are intermediate between male and female—so-called *intersexes*. When these are carefully examined, it is seen (by an examination of their hard parts, which, once formed, cannot be remoulded) that they have started their development as females, but ended it as males. They are females which suddenly, during their growth, have by some invisible but inexorable power been switched over to become of the opposite sex. All degrees of intersexuality are known, according to the races employed in the cross. The females may show only the faintest traces of maleness; may be equally male and female; may be preponderatingly male; or finally, in certain crosses, the change of sex may come so early that no trace of female characters appears, and the cross results in males alone. (See Fig. 3.)

Even though half of these all-male broods ought by rights to be females, yet all behave like normal males, and can mate and produce offspring. With these experiments, carried out over a long series of years by Professor Goldschmidt, of Berlin, we can at last be sure that it is possible for a complete and functional reversal of sex to take place.

When the cross is made the other way, with a Japanese female and a European male, the first generation is altogether normal. But in the second generation abnormal individuals again appear. This time, however, they are different from those first seen, and on analysis turn out to be intersexual males—*i.e.*, animals which have started as males and been forced to finish their development as females.

What is the explanation of these strange facts? It appears to lie, ultimately, in the different climates to which the different races are adapted. The Japanese races are adapted to grow more rapidly.

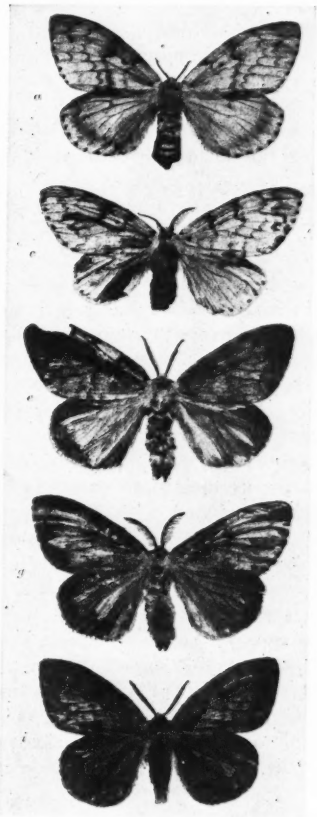

FIG. 3.—GIPSY MOTH (*Lymantria dispar*); SERIES OF INTERSEXUAL FEMALES.

Above, slight intersexuality; below, almost complete transformation to maleness.

By permission of the Editor of the "Journal of the Royal Society of Arts." (After Goldschmidt.)

The factor which produces maleness must lie in the sex (X) chromosome, which in moths is double in males, single in females. The factor producing femaleness we cannot yet locate so definitely; but it has been shown to be transmitted always and only through the mother; let us call it Q. Then all the

factors in the Japanese race are geared at a higher rate than those of the European race—are producing more of the characteristic sex-determining substances in a given time. Let us mark this difference by calling the sex-factors of the Japanese race X+ and Q+, those of the European race X− and Q−.

The cross Japanese male X European female will, as a minute's calculation will show, give female offspring with a "strong" male and a "weak" female factor—X+ combined with Q−. Both male and female factors are producing their determining substances; in a normal female Q keeps ahead of X in its production; but here the "strong" X+ is producing too fast for the "weak" Q−, and after a time catches it up. From this time forward, there is an excess of male-determining substances, and the animal must finish its growth as a male. The opposite result, when the production of female-determining substance gradually catches up and surpasses that of the male-determining, only seems to occur when a "strong" female factor, Q+ is combined with two "weak" male-producing factors, X− X−, and this can only come about in the second generation after a cross.

Similar reversals of sex are known in other animals, in shrimps, in frogs, and probably in hens. Indeed, it is quite possible that some sexually abnormal human beings are the victims of this sex-reversing power, and deserving, not of the opprobrium which they generally receive, but of pity for being in the grip of inexorable hereditary forces.

There is one curious consequence of intersexuality. If it goes so far as to lead to complete reversal, an animal will be produced with the appearance and functions of one sex, but the chromosome-constitution proper to the other. When such an animal comes to reproduce, this must lead to upsets of the sex-ratio in the next generation. In frogs, for instance, the sex chromosomes are probably XX in the female, XY in the male. When a female is converted into a functional male, she (or he, as we should now say) will still have the two X's. Therefore, when this animal mates with a normal female, which will also possess two X chromosomes, all the sperms and eggs alike will contain an X, and all the offspring will therefore be XX in constitution, and therefore females. Such an experiment has actually been carried out, and nothing but females obtained among the seven hundred odd offspring.

Space forbids us to enumerate more of these experiments, for, remarkable as some of them are—for instance, the fact that if a frog which has started to lay is stopped, and the rest of the eggs fertilised three or four days later, they will all give rise to males—we have as yet no explanation for them.

We must conclude with a short consideration of sex-determination in mammals and man. As we might expect, here too sex is normally determined at the moment of fertilisation. This is shown particularly well by the fact that whenever a single fertilised egg divides so as to give rise to two or more offspring, these are always of the same sex. This occurs as a normal event in the Texas Armadillo, as an exception in so-called "identical" twins in man. Other twins, and the members of the same litter in most animals, are equally likely to be of opposite sexes.

One of the most puzzling things so far discovered about sex is that the ratio of males to females is not always equal, and may vary from species to species, and at different seasons of the year. The fact that one sex possesses two, the other one X-chromosome should inevitably produce equal numbers of males and of females. Yet in man, for instance, the ratio of male to female births is about 107 to 100, and if we take into account the embryos which die before birth, the ratio of male to female conceptions is about 130 to 100. In many breeds of animals, again, the percentage of females is greater when the breeding season is at its height, the percentage of males greater whilst fewer young are being born. Recently it has been asserted by Siegel, on the basis of a good deal of evidence, that in man the percentage of males varies very considerably according to the time during the monthly period at which fertilisation or conception takes place. If this proves to be true, the power of controlling the sex of our children, of having boys or girls at will, will be to a considerable extent within our grasp. But in face of the fact that a great many other so-called specifics for controlling sex have turned out to be worthless, it is as well to be cautious. It has been maintained, for instance, that the right ovary produces eggs giving rise to boys, the left those which give rise to girls; or that the formation of male-producing and female-producing eggs alternate, first one sort and next time the other being given off. But it has been definitely shown that there is no foundation for these and many other similar statements.

There is, however, one understood fact which may prove to explain many difficulties. As we have already seen, male mammals have but one X chromosome. Their sperms therefore are of two kinds, one with, the other without an X. Where careful examination has been made, it is found that these two sorts of sperms can be distinguished by the microscope, those without an X being smaller. It is quite possible that these smaller sperms may be more delicate, or, in their long journey to reach the ovum within the female's body, may swim at a different rate from the larger. In any case, anything which affected the two classes of sperms differently would lead to a difference in the proportion of males and females produced.

The whole problem, as will readily be seen, is far indeed from solution. But here too we have made enormous strides in the last twenty years, and instead of the vague generalities which alone were possible before, can see the main lines along which the solution is to be sought.

We can see the characters and instincts of the two sexes as two divergent possibilities of human or animal constitution, both present potentially in all individuals of the race, and only waiting the right soil to develop. From this point of view it is easy to understand the fact that has struck so many observers of human nature, that feminine characters are often latent in men, masculine in women, and in particular circumstances may emerge, to their owner's surprise and sometimes confusion. The fact of intersexuality shows us that we may have to revise not only our moral judgments but our legal practice with regard to various abnormalities of sex in human beings, and the knowledge we have acquired of the sex-chromosomes is bound in the not-too-distant future to lead to a considerable measure of control over what until recently was one of the greatest mysteries of life.

(Concluded.)

The Determination of Sex. L. DONCASTER. (Cambridge University Press, 12s.)

Inbreeding and Outbreeding. E. M. EAST and D. F. JONES. (Lippincott, 10s. 6d.)

The Descent of Man. C. DARWIN. (John Murray, 9s.)

The Physical Basis of Heredity. T. H. MORGAN. (Lippincott, 10s. 6d.)

The Study of English Place Names: A New Scheme

THE study of English place-names has entered upon a new phase with the institution of a co-operative scheme for their investigation by Professor A. Mawer, of Liverpool University, under the ægis of the British Academy. The essential features in Professor Mawer's scheme are that an attempt will be made to cover the whole of England, and that the evidence of anthropology and archæology, of history and geography will be taken into account as well as the linguistic element. An account of the work of the Survey was given by Professor Mawer at a meeting of the Royal Anthropological Institute held on June 27th. He said that from the earliest times, the value of place-names as a possible source of historical knowledge had been recognised. Much early history had frankly been invented from them, and historians had speculated freely as to their meaning. More recently, scholars like Kemble had seen the possibilities latent in place-names; but until Professor Skeat first put Place-Name Study on its only secure basis, viz., the study of the early forms of the names, most of the work in this direction was only idle speculation. Conducted on scientific lines, Place-Name Study could do much to throw fresh light on the dark places in the history of our country and its civilisation, where we had no documentary evidence or only such as had long since been worn threadbare. Place-names and archæology were the only unworked sources of evidence still remaining open to us, and these studies should be conducted in close touch with one another. It had gradually come to be realised by workers in the field that we needed co-operative effort if ever we were to glean the true harvest of knowledge from place-names. The reasons for this were that (*i*) no safe inferences, either particular or general, can be drawn with reference to the names of any area except in the light of the full evidence for at least the whole of England; (*ii*) the range of interests, historical, linguistic, topographical, and archæological, concerned in the problems of place-names was so wide that they could not be dealt with adequately by any single scholar. Accordingly a scheme had been initiated under the patronage of the British Academy for a Survey of English Place-names, with a view not only to the interpretation of the individual names, but also to the drawing from them of all that wealth of historical and cultural lore which was latent in them. During the Survey's first six months of work a start has been made in several counties; many eminent scholars skilled in the various aspects of the work are giving active help, and close relationships have been established with the two Public Offices most immediately concerned in the matter, viz., the Ordnance Survey and the Public Record Office.

E. N. FALLAIZE.

New Light on a Neglected Century of British Sculpture

By Katharine A. Esdaile

ENGLISH mediæval sculpture has never lacked admirers, but its post-Restoration successor is still curiously neglected, and writer after writer has been content to repeat the information contained in Walpole's *Anecdotes of Painting* without reference to

Walpole's sources, the Vertue MSS.,[1] once his own and now in the British Museum. Walpole himself was handicapped when dealing with these sculptors, since the most interesting volume was closed to him as a man of honour. "It is my wish," wrote Vertue on the title page of this book, "that this volume markt A. f. be at my death immediately ty'd about with string [and] seal'd up till the year 1772 or fifty years after my death." Unused, if not unopened, it

FIG. 1.—BUST OF WREN. By EDWARD PIERCE.
Ashmolean Museum, Oxford. Photographed by kind permission of C. F. Bell, Esq., Department of Fine Arts, Ashmolean Museum.

has apparently remained, but its contents may be said to revolutionise our knowledge of such men as Rysbrack and Scheemaker; and it is these contents, together with other matter in the unsealed volumes, here presented in inverted commas, which form the basis of the present study.

Fully to understand the sculpture of the period in question, we must know something of the opportunities that lay before the sculptors. When the Restoration came in 1660, the older generation of artists had almost disappeared during the twenty years of Civil War and Commonwealth rule; Le Sueur was dead; Fanelli had gone abroad; Stone was dead; though his sons, the younger Nicholas and John, were still at work. There were cogent reasons for the employment of new men. The Court had been and long remained in close touch with Versailles, where royal patronage of art and artists was already a tradition, and where the influence of Bernini and his followers was supreme; the nation overflowed with loyalty, and royal statues were an obvious method of demonstrating it; the Grand Tour was coming into vogue, and with it the habit of connoisseurship and the desire to bring the English mansion into line with the villas of France and Italy. Royal and noble patrons were ready to fill their palaces and gardens with sculpture ancient and modern—the former often needing restoration and therefore offering abundant employment to contemporary artists—and their parish churches with monuments to their dead ancestors and themselves. The middle classes, too, were getting richer, and had begun to live in a style which demanded greater luxury; the fashion for ornate tombs, moreover, had spread, and the results are visible on the walls of a thousand churches. Hence they, too, were ready to employ the sculptor's services, as well as to demonstrate their loyalty by putting up commemorative statues of the restored sovereign. From London to Lichfield the saturnine features were made familiar, and the Royal Exchange alone contained four statues of Charles II. Above all, the Great Fire offered an opportunity which no other event since the burning of Rome under Nero can parallel. St. Paul's, the Royal Exchange, and fifty-two churches, besides thousands of houses, the City Halls and the Monument itself, were built or rebuilt, apart from the fifty new churches commissioned in the reign of Anne; and as the sculptors of the day, like Stone in the last age, were often prepared to act as architects and monumental masons, the field thus opened was enormous.

The Revolution brought yet another change. William III., a delicate man, required country air; hence the palaces of Kensington and Hampton Court took the place of Whitehall in the reign of the earlier Stuarts as centres of artistic activity, and Cibber, Gibbons, and Pierce found fresh employment there under the all-supervising Wren. In the next reign came a great series of victories which led to the erection of monuments, as yet by individuals only, as

[1] To George Vertue, engraver and antiquary (1684–1756) we owe almost all our biographical knowledge of seventeenth- and eighteenth-century artists, sculptors, and engravers. Walpole avowedly "offers to the public the labours of another person," and appends the life of Vertue to the *Anecdotes*; but in dealing with the sculptors he was handicapped by Vertue's wish of secrecy about much of his material; he was an old man when the later volumes appeared; and, his own chief interest being in painting, sculpture received less attention than was its due. Vertue's information on the subject was first systematically used by the present writer in a series of articles on the British Sculptors from Pierce to Chantrey, which have appeared in *The Architect* during 1921 and 1922, and are still uncompleted.

a means of expressing national emotion, the impulse given by Marlborough's wars lasting until Waterloo. A generation later the new interest in scholarship shown by constant new editions of the works of our older writers brought about the commemoration of Shakespeare, Milton, and Ben Jonson, who took their place at Westminster beside such contemporary idols as Cowley, Butler, and Congreve. The Abbey, in fact, was beginning to be looked upon as the epitome of our history, where literature, arms, politics, and music had equal rights; and it is surely a tribute to the spiritual insight of the eighteenth century that Museum, and the model of the head of Milton—after 1654, since the poet is obviously blind—now at Christ's College, Cambridge, once in the possession of Vertue himself. As Pierce's father, originally an assistant of Vandyck, was employed at Whitehall, one can only conjecture that the son was somehow brought into contact with the Protector and his Foreign Secretary. Evidently, however, such employment was no bar to royal patronage, since Pierce not only contributed two statues to the Royal Exchange of 1667, but worked at Hampton Court, was the architect of the Dial at Seven Dials, and

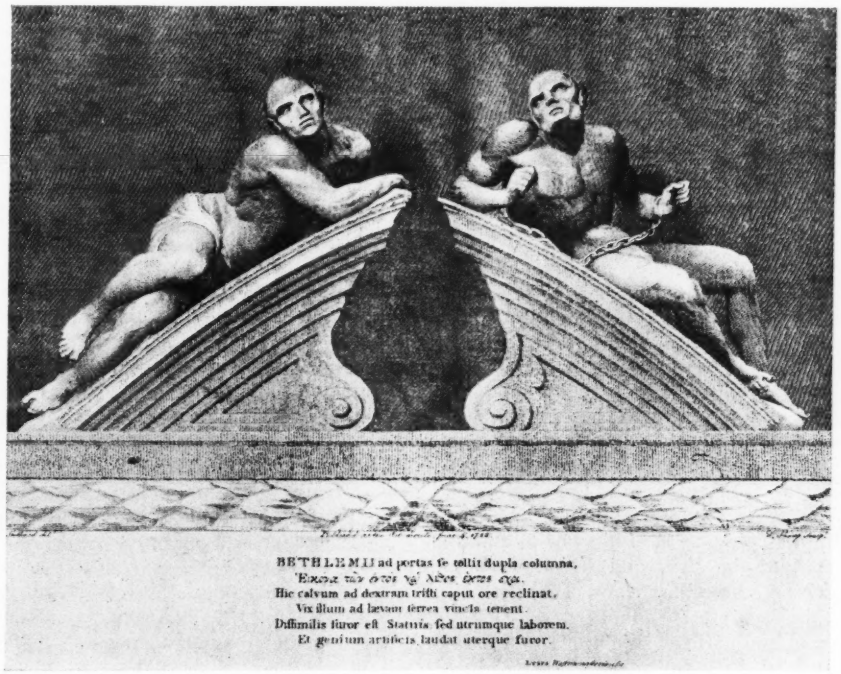

FIG. 2.—CIBBER'S "RAVING AND MELANCHOLY MADNESS."
Formerly over the gates of Bedlam, now in the Guildhall Museum.

Westminster Abbey came to be regarded as the natural resting-place of the man of letters.

With these conditions, these openings for employment, temporary and permanent, in our minds, we may briefly discuss the history and achievement of our century of English sculptors.

Edward Pierce, the son of a man of the same name, "Citizen and painter-stainer of London," was working under the Commonwealth and did not die till 1698. His known output is unfortunately small, but like that of Stone before him, and Cibber, Gibbons, and Bird after him, is both architectural and sculptural. His earliest works are the superb bust of Oliver Cromwell recently acquired by the Ashmolean became the colleague both of Wren and Bird. For the former he carved the four dragons on the Monument; as "mason" he assisted to build St. Clement Danes; and above all he produced that glorious bust, now like the Cromwell at the Ashmolean Museum, of which Vertue wrote in his characteristically bad grammar and spelling, "In Bodleyan Gallery the Bust in Marble of Sir Christ[r] Wren done by . . . Pierce the Same person as my moddel of Milton." This is the finest bust of purely Berninesque[1] type in

[1] Lorenzo Bernini (1598–1680), the founder of the late florid style of art and architecture known as Baroque, was incomparably the greatest architect and sculptor of his century, and his influence all over Europe was supreme until the days

England, and one of the triumphs of English art. On the rest of Pierce's work we cannot linger; it must suffice to say that his most florid monumental work is to be seen in the splendid monument to Sir William Maynard in the little church of Little Easton, Essex, and the drawing for a monument, never erected, to the Second Duke of Buckingham, Dryden's Zimri, of which the writer last year published a reproduction (*Architect*, September 2, 1921, p. 137).

The work of Pierce is typical of the course of English sculpture. Now it is decorative, now architectural; now he is employed on tombs, now on portrait busts and statues like that of Sir William Walworth at Fishmongers' Hall; but he must, like many of his fellows, have fallen into poverty in his old age, since all his pictures and models were sold by auction in 1695. He "lived and died," as Vertue tells us, "at his hse lowr end of Surrey street in the Strand, buried at St. Mary le Savoy."

Caius Gabriel Cibber (1630-1700), a Dane born in Flensborg, came to England in 1659, and is therefore the first of the new generation of foreign sculptors domesticated in England to whom the new conditions of English social life offered such wide and lasting opportunities. At once architect, decorator, sculptor, and monumental mason, he also typifies the age of Wren, and his work, as sculptor especially, ranks far higher than it is the fashion to allow. His most famous works, more familiar to an earlier generation than to this, are the Michael Angelesque statues of *Raving and Melancholy Madness,* figures typifying two forms of insanity, once over Bedlam Gates and now in the basement museum of the Guildhall, which Roubiliac, the greatest sculptor of the eighteenth century, would go out of his way to admire whenever he went to the city, and which were to furnish Pope with an admirable means of lashing his favourite butt the sculptor's son, Colley Cibber, laureate and dramatist, when he described in the *Dunciad* how

> " O'er the Gates, by his fam'd father's hand,
> Great Cibber's brazen, brainless brothers stand."

Cibber was, like Pierce, an assistant of Wren, working for him on the Monument, on which he executed the great bas-relief representing the restoration of London, at Hampton Court, Trinity College, Cambridge, and St. Paul's. He did most of the statues for the Royal Exchange, and was the architect of the old Danish Church in Wellclose Square, besides executing much decorative work at Chatsworth, both indoors and out. He produced an admirable *genre* statue of the Blind Piper, and the statue of William of Wykeham at Winchester, the latter a species of bribe addressed to the authorities to procure the election of his son Lewis to the foundation as Founder's Kin. A portrait or two, some wooden statues of Saints, a Berninesque fountain in Soho Square, with statues of Charles II. and four river-gods, fairly represent his output, though his best work is to be seen in two monuments which rank among the noblest of their day. These are the glorious Sackville tomb at Withyham, Sussex, showing the parents of Lord Richard Sackville kneeling on either side of the recumbent figure of their son, and the stately monument of Heneage Finch, Earl of Nottingham, at Ravenstone, Bucks, this last not hitherto included among his works, though Finch tradition, confirmed by the style, declares it to be his. The same tradition states that the sculptor was so distressed by the squint he had given to the figure that he committed suicide, but the legend, as in the case of another monument in Winchester Cathedral, is clearly a case of *post hoc, propter hoc,* since Vertue, who knew much of him, never heard of it. " He was a gentleman-like man and a man of good sense, but died poor, left a son a player," is the antiquary's brief epitaph on a sculptor who imitated Bernini in his fountains, worked with and for Wren and Bird, and impressed generation after generation with his following of Michael Angelo in his *Raving and Melancholy Madness* which may without exaggeration be termed the strongest imaginative work executed in England between the Restoration and the rise of Roubiliac.

The romantic story of John Bushnell (d. 1701), most inadequately told by Walpole, deserves to be more widely known. He left his master, Thomas Burman, one of the last of the school of English alabaster sculptors, for foreign travel, spent two years in France and visited Italy, not Rome only, but Venice. " He took pleasure," as Hogarth's father-in-law, Sir James Thornhill, told Vertue, " to travel as a poor fellow and workt in several towns. At first, with Masters, he would enter himself as a labourer or poor fellow, and after some time, surprise them by doing better and better." His unidentified monument at Venice, like his work at Hamburg, which he visited on the way home; his disappointment over the Royal Statues on the Exchange, of which he did only two instead of all; his figures on Temple Bar; his glorious Mordaunt monument at Fulham, so long unjustly attributed to Bird—for these things the reader must be referred to *The Architect* (October 7th, 1921). His life was a failure. Contemporaries laughed at his figures, " great and spirituous " as

of Winckelmann, the pioneer of the modern study of Greek art, and the Neo-classic school of sculptors who broke with the existing traditions and deliberately based their work on Greek or rather Græco-Roman art. What this meant may be seen by contrasting the work of Flaxman and Canova with that of Bernini, the recent acquisition of whose bust of " Mr. Baker " by the Victoria and Albert Museum is an event of national importance. A comparison of this work with Pierce's bust of Wren here illustrated will show the source of the younger sculptor's inspiration.

Vertue justly found them. His projects miscarried; his one colossal oil painting "of a Triumph," found no purchaser; his very house in Park Lane, "the lane from Piccadilly to Tyburn," remained unfinished. He lost his money in a scheme for bringing coals to London by sea; he lost his estate in Kent by a lawsuit; he lost his reason; his model of the Trojan Horse, a sort of glorified drinking booth, in whose head twelve men could sit, was wrecked by a gale; and his only consolation was the devotion of his family, two sons and a daughter, who lived on in the desolate half-finished house and told Vertue, who had a long interview with them in 1725, and saw with pity the ruined relics of poor Bushnell's ambitions, that the world was not worthy of their father.

Some idea of the peculiarities of Bushnell's style may be gathered from the Charles I. and II. which the writer identified last year in niches on the first landing of the Old Bailey, which, with Gibbons' Charles II. in the Royal Exchange, are now the sole survivors of that lost Pantheon of the English Kings, the Royal Exchange of 1667. The Berninesque draperies, the intense unresting vigour of the lines, make them unique among English sculpture, though, like the statues on Temple Bar, they are marred by a certain amateurishness which is even more conspicuous in other works, and is wholly lacking only in the splendid figure of Viscount Mordaunt at All Saints', Fulham, his undoubted masterpiece.

If Pierce, on the strength of his portrait busts, may be called the English Bernini, Bushnell is no less unquestionably the most Berninesque of our decorative artists. The proud swell and volume of his draperies, the vitality and poise of his figures, are unique in English statues; the Charles I. would not be out of place on the Bridge of St. Angelo, nor the Mordaunt, a work finer because intended to be seen at closer quarters, in St. Peter's.

Grinling Gibbons (1648-1721), best known as a woodcarver, is also a considerable sculptor whose two statues of Charles II. at the Royal Exchange and Chelsea Hospital, and the far finer James II. at Whitehall, should endear him to all Londoners. He also executed tombs of varying sizes, from the colossal Campden monument at Exton, Rutland, to the miserably defaced slab to William Courten in St. Mary Abbot's, Kensington; two excellent fonts, those at St. James's, Piccadilly, and St. Margaret Lothbury; and much of the stone work at Hampton Court, as well as various portraits of which the most accessible is the charming medallion of Wren at the R.I.B.A. To enumerate his masterpieces in wood is quite impossible. From St. Paul's to Canterbury, from Petworth to Cambridge, England is full of them, and Walpole's verdict that he "gave to wood the loose and airy lightness of flowers" remains unassailable. Working in bronze, marble, stone, wood, and ivory, raising himself from the humble youth who, as Stone's nephew told Vertue, "had a shop at Deptford" and was there discovered by Evelyn at work upon "that large cartoon of Tintoret," which Evelyn found it hard to forgive the Court for ignoring, he subsequently became Master Carver to every English sovereign from Charles II. to George I. But his head was never turned; he inspired his assistants with his own enthusiasm—one of them lost his life in a successful attempt at saving

FIG. 3.—FONT IN ST. JAMES'S, PICCADILLY. By GRINLING GIBBONS.

the carved room at Petworth—and remained always what Evelyn had found him as a youth, "very civil, sober, and discreet." He died at a good old age in 1721, and was buried near his last bust of Sir Peter Lely in St. Paul's, Covent Garden.

The great artists of the reign of George II., Scheemaker, Rysbrack, and Roubiliac, are men of different calibre. All came to England when very young, and all lived and worked in their adopted country. Peter Scheemaker (1690-1771?), a Fleming of great natural gifts, improved his art by sheer hard work in Italy, and was the first of our sculptors to have an historical conscience. He studied his Edward

VI. at St. Thomas's Hospital from Holbein's picture, his Shakespeare in Westminster Abbey from the Chandos portrait; modelled his Ancient Worthies at Stowe on the Antique; copied Michael Angelo, Bernini, and Fiammingo for practice; and erected countless monuments varying in scale from the small to the colossal, but never careless or negligible.

John Michael Rysbrack (1693-1770), the greatest historical sculptor whom England has seen, has a finer sense of design and is a far finer craftsman. His terra-cotta models in the Soane Museum are works of art, and he succeeds in more fields than any other English sculptor. Whether his subject is an equestrian statue, an historical scene, an allegorical bas-relief, a living man or a dead hero, he treats it with originality, power, and that sense of style without which art cannot exist.

But if Scheemaker and Rysbrack were excellent artists, Louis François Roubiliac (1695-1762) was, in Allan Cunningham's words, "a genius and a gentleman." As I have elsewhere shown, he came to England far earlier than is commonly supposed, and never left it save for a brief visit to Italy. He executed the best portraits of the greatest men of his day, Swift, Pope, Handel, Hogarth, Garrick, Bolingbroke, and knew most of his sitters intimately besides; his monuments are masterly; his statues, of which the Newton at Trinity is only the most famous, noble works of art. "Ruby," as Fielding affectionately called him, was loved by all who knew him, and met his death through devotion to his art. Adequately to deal with his work would need a volume; but no account of English sculpture during the century from the Restoration to the death of George II. can omit a tribute, however brief, to its last and greatest artist.

BIBLIOGRAPHY.

The Vertue MSS. apart, the principal sources of information are very few, and many of the dates and particulars here given will be found to contradict those usually printed. The authority of the MSS., however, is overwhelming, since Vertue wrote from personal knowledge of all the sculptors here mentioned, Pierce excepted. The relevant passages have been printed in full by the writer in *The Architect*, 1921-2, and must be accepted in place of the inaccurate and second-hand statements found elsewhere.

Architect, The. Studies of the English Sculptors from Pierce to Chantrey [by Katharine A. Esdaile]: July 1, July 8, September 2, September 16, September 30, October 7, October 21, December 9, 1921. February 10, March 3, April 7, April 21, June 16, June 23, 1922; in progress.

Chancellor, E. Beresford: *Lives of the British Sculptors*, 1911.

Cunningham, Allan: *Lives of the English Sculptors*, 1831.

Dallaway: *Anecdotes of the Arts in England*, 1800. Inaccurate and scrappy.

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Faber, Harold: *Danske og Norske in England*. Copenhagen, 1915. By far the best account of Cibber, though omitting one or two important works.

Sainte Croix, Le Roy de: *Vie et Œuvres de L. F. Roubiliac*. Lyons, 1882. An enthusiastic appreciation, whose value is lessened by the author's ignorance of English and by his constant inaccuracies.

Smith, J. T.: *Nollekens and his Times*. Ed. Wilfrid Whitten, 1920. (John Lane, £1 11s. 6d.) Indispensable

Walpole, Horace: *Anecdotes of Painting in England*. Ed. Wornum. (Out of print.)

Most indispensable of all is the study of the monuments themselves; provisional lists of works by the various sculptors will be found in *The Architect*.

Notes and News of the Month

ARTIFICIAL DISINTEGRATION OF THE ATOM.

THE attention of the public has been recently called by a section of the Press to the unpleasant eventualities which recent work on the artificial disintegration of the atom has made possible. Reports, of course, have been greatly exaggerated, but many would like to know whether or not any truth whatever lies at their base. We have been told that "an atom may blow up the Earth," that "the world is on the verge of the greatest scientific triumph of the ages," that hot stars may have evolved from cold earths like ours because beings living on them "have been monkeying with their atoms," and so on. It is a pity that newspapers make stories out of a little of the latest science, a few interviews with scientific men suitably embellished, a vivid imagination and a breezy or a forced breezy style. It is a pity, too, that there should be such a great gulf fixed between the science of anticipation—that glorious, exciting, gripping, and romantic thing which really interests us all—and the science of real things discovered in laboratories by patient men, who fortunately escape being interviewed, which by comparison is almost a thing of naught.

It is well known that artificial disintegration has been effected in the laboratory—a great and very important advance in science. But the study of the phenomena involved has taught how extremely difficult a process it is, and on what an excessively minute scale it has yet been effected. Special materials are required which are extremely rare in nature, and which, apparently, cannot be manufactured. The conclusion from these experiments is that there is little or no hope either of the process of artificial disintegration being rendered possible on what is called a commercial scale, or (what is nearly the same thing) that boundless quantities of energy can somehow be generated by the process by which so far a little has been tapped. And these are the only experiments which

have led to positive results. There are other experiments, however, on which speculation sets great hopes, which consist in outline (as one newspaper put it) in giving "the solar plexus of an atom a two million volts punch." But so far such punches have done nothing. Perhaps some day they will, but that is another story. Advances in science to-day as in the past are real enough but gradual—very gradual. It is best to wait and see; and, to see the advance in realities, a fairly large-scale map is necessary.

A. S. R.

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PROGRESS OF CIVIL AVIATION.

THE latest Half-Yearly Report on this subject published by the Air Ministry contains facts and figures worthy of attention. It covers the period October, 1921—March, 1922. The period shows an increase in British carried passenger traffic with the Continent over that of the same period in 1920-1921, the total number of passengers carried on British machines being 1,686, as compared with the previous 1,418. This period has established a safety record, for there was not a single fatal accident to any machine of any nationality.

Arrangements are being made for opening the English section of the London-Paris route for night flying. Aerial route lights are being set up at Tatsfield Hill and Cranbrook, and an automatic illuminated ground sign, which will be situated at Penshurst emergency landing ground. These various lights will operate for a year without attention. In addition, an automatic wind indicator for night flying has been completed at Croydon, while the progress made with searchlights and other apparatus designed to simplify night landing has placed the Croydon and Lympne aerodromes in a position to cope with night services at short notice.

Some interesting details are given of projects and undertakings in other countries. In Australia, for instance, tenders have been received from various firms and accepted by the Government, not only for the Geraldton-Derby air service, but for working lines between Sydney and Adelaide, Sydney and Brisbane, and Charlieville and Cloncurry (Central Queensland). When these plans are put into effect, direct overland communication will exist between the north and south regions of Western Australia, Geraldton being connected by rail with Perth, while South Australia, New South Wales, and Queensland will be placed in quick touch with one another. It is to be expected that Germany will now forge ahead with air schemes, for last February the Conference of Ambassadors fixed May 5th as the date on which the Republic might resume the manufacture of civil aircraft. At present there are in Germany five important air transport companies, and twelve air routes have been approved for regular operation by the Ministry of Transport. We may also see Sweden playing an important part in Continental air travel before long, for the Swedish Aeronautical Commission's report on civil aviation recommends the establishment of three air lines—Stockholm-Goteborg, with connections to Petrograd and London, to be operated by airships; Stockholm-Malmo, with connection southward to the Continent; Malmo-Goteborg, with a connection to Christiania. Suggestions are also put forward for a direct airship service between Stockholm, Berlin and Southern Europe. In the United States the chief use of air flight has been made by the Post Office, 25,496,560 letters having been thus carried during the period July 1st, 1921, to June 30th of this year.

Another announcement from the Air Ministry informs us that a new company, probably with the title of the British Marine Air Navigation Company, Ltd., is being formed to operate services between Southampton and the French ports of Cherbourg and Le Havre, and possibly later a Channel Islands service. The existing British services use land types of aircraft only, but the new company intends employing special marine aircraft.

E. L.

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SPINOZA.

THOSE of our readers who have investigated, slightly or deeply, the doctrines of pantheism will be interested to hear that an international society (*Societas Spinozana*) has been lately formed for the study of the philosophy of Spinoza. This most famous of all modern advocates of pantheism was born at Amsterdam in 1632, and died at the Hague in 1677. His system of philosophy considered God as both the cause and substance of the universe, advocated the necessity of the Divine nature, and abolished the idea of free-will.

The new society proposes to hold conferences at fixed intervals, to reissue rare books and documents relating to Spinoza, and to publish an annual volume of original studies. The first volume of these studies has already been published, and includes contributions from Dr. Harold Höffding, Sir Frederick Pollock (who is English representative on the Society), and Professor Léon Brunschvicg. It is printed with type specially cast in imitation of the fount used in the original edition of the *Ethics*, Spinoza's most important work, which was not published till after his death.

The headquarters of the society are at the Hague, but British persons interested in its work are invited to communicate with Mr. L. Roth, Exeter College, Oxford.

E. L.

Reviews of Books

THE POPULATION PROBLEM.

The Population Problem: A Study in Human Evolution. By A. M. Carr-Saunders. (The Clarendon Press, Oxford, 21s.).

Mr. Carr-Saunders' study of the population problem is planned on comprehensive lines. As his sub-title indicates, it is not a contribution to the discussion of any one aspect of the problem; it deals with the whole, or, at any rate, with the main features, from an historical and evolutionary point of view. The chief elements in the problem are traced back to their origin in the biological, anthropological and economic factors which determine the way in which any collection of individuals is organised as a human society. In so far as it does this, it advances discussion by a clear-cut statement of the essential elements of the problem; but its appeal is directed not so much to the specialist as to those who have a general interest in the question. For such readers Mr. Carr-Saunders' careful and lucid summary of the evidence afforded by the latest researches in connection with reproduction, heredity and variation, and their bearing upon the question of the numbers and the character, both physical and mental, of any given population will be of great value. He is to be congratulated upon the ability with which he has so handled his material—material, be it said, of a highly technical character—as to render it intelligible to those who have no intimate acquaintance with the data of the sciences from which he has drawn his arguments. It must be accounted as a merit that the book is written throughout with regard to the anthropological point of view. It must also be admitted, however, that the author's style does not make for easy reading, and is even at times a little irritating.

The discussion of the population problem may be said to begin with the publication by Malthus in 1798 of his *Essay on Population*. His views had to some extent been anticipated; but the subject had received little more than superficial or partial treatment by classical, mediæval and earlier modern writers. In the main, interest had been directed to the question of numbers. The desire for national aggrandisement had focused attention on the desirability of a large population. Malthus expounded the relation of population and food supply. He maintained that, while population increased in geometric ratio, the food supply increased in arithmetical ratio only; but that undue increase of population was checked by vice, disease and misery. Although the accuracy of his data was impugned, his views had a profound effect on the thought of the nineteenth century, notably in their influence on Darwin and Wallace.

Mr. Carr-Saunders bases his examination of the problem on the relation of fecundity (potential production of offspring) and fertility (rearing of offspring). In Nature, he points out there tends to be a more or less constant balance. Notwithstanding the large number of offspring which may be produced, especially among the lower organisms, a variety of checks operates to secure that the number of adults remains fairly constant. These conditions once applied equally to the ancestors of man. Owing, however, to the evolution of reason, the problem now assumes an entirely different form. There appears in the case of man to have been an increase of both fecundity and fertility. The author is of the opinion that human fecundity is usually underrated, and in this connection it is of interest to cite some of his figures. A population of a million, half males and half females, each couple producing two children before the age of twenty, and themselves then dying, would, he estimates, produce a constant population of one million; but with an average of two-and-a-half children the population would increase to 3,050,000 in one hundred years, while an average of five children would produce 97,650,000 in the same period.

As it is obvious that the human race has not increased and does not increase at anything like this rate, Mr. Carr-Saunders' aim has been to show what are the causes at work to keep this rate of increase in check. He finds that there appears to be an optimum[1] number in any given society to which population tends to approximate. The checks operative among species in a state of nature, that is the dangers to which offspring are exposed, decrease, but their place is taken by others. Numbers may be kept down by natural selection, but there tends to be some partly conscious adjustment on the part of individuals. In a very able review of the anthropological evidence afforded by primitive peoples, he shows that a variety of factors tend to keep the population somewhere near the optimum level. Among these are intercourse before puberty, contraceptive methods, abortion, infanticide and analogous practices, as well as prolonged lactation, lack of care of children, war, disease and migration. No one of these appears to be peculiar to any one grade of culture; they appear whether the community be engaged in hunting and fishing, pastoral pursuits, or in agriculture. The explanation of this fact probably is that communities confining themselves exclusively to one mode of existence are the exception, whereas in the evidence adduced by the author, the main occupation is made the basis of classification and treated as if it were the sole occupation. Indeed, he himself points out how the prevalence of the different varieties of checks varies according to conditions. Among a nomadic people, for instance, one of the factors in determining the number of a young family will be availability of means of transport for children. This would probably operate in the direction of one set of checks, while a mode of existence, partially nomadic, partially agricultural, such as is found

[1] Optimum number in this connexion means that number at which in any given society there is such a balance between population and means of subsistence as will secure the most favourable conditions for the individual and the community as a whole, having due regard to the stage of development in civilisation of that society.

among tribes of nearer Asia, would operate in the direction of another set. From the nature of the case, however, evidence is partial and scanty. Not only do the checks on population vary, but the optimum number also is not constant, and varies in like manner with the conditions. Mr. Carr-Saunders' analysis of conditions in the Middle Ages and their effect on population, which bears out these points well, is extremely interesting and worthy of close attention.

The problem which Malthus stated as one of food supply is now seen to depend rather upon the relation between density of population on the one hand, and the maximum return of industry on the other. So long as skill increases, so long will it continue to be desirable for the population to grow larger. A population which is either too large or too small will fail to attain the maximum return of industry. Mr. Carr-Saunders is of the opinion that in India, Egypt and China we have cases in which the checks operating on increase of population are not adequate, and over-population probably occurs. He shows further that in a primitive society the balance between density of population and the maximum return of industry is dependent upon two factors. The first of these is that in a primitive community, whether sedentary or nomadic, the tribal boundaries are strictly defined—a fact which is often overlooked by writers on primitive society—and the means of subsistence are consequently subject to definite limitation. The second is that there is among primitive peoples complete social co-operation in providing the necessities of life. It is clear that, in so far as any society fails to secure complete co-operation among its members, we cannot say that there is any fixed number of population which would be the best in the interest of the whole community. It is, however, doubtful how far the complete social co-operation which the author postulates in theory would be found, even among primitive races, in practice.

In order to survey the specifically human aspects of the biological problem, Mr. Carr-Saunders places before his readers a lucid summary of the geological, palæontological and anthropological evidence relating to the antiquity and descent of man. It would perhaps have been an advantage had this evidence been a little more fully discussed, especially in regard to the relative merits of the various time measurements put forward for the different geological epochs upon which the evidence for the antiquity of man depends. Presumably he does not consider that this evidence (nor even some recent discoveries and investigations, notably that of the Rhodesian skull, unless indeed this was made too recently for consideration) materially affects his argument. He holds that by late Palæolithic times man's evolution, both physically and mentally, was to all intents complete; and he concludes that we may assume that the checks operative among primitive peoples were also operative among prehistoric races. This conclusion, however, is subject to a reservation. He holds that it must not be too readily assumed that conclusions based upon the practices of primitive people are completely applicable to prehistoric times. This is a perfectly sound measure of precaution, frequently overlooked by too eager students of the mentality of prehistoric man.

Mr. Carr-Saunders' analysis of the qualitative aspect of the problem, *i.e.*, changes of type of population, an aspect which he regards as indissolubly linked with the quantitative, is of extreme interest, but unfortunately lack of space precludes its adequate discussion. His treatment of it is hardly as successful as his handling of the quantitative aspect, *i.e.*, of increase and decrease of population, and it is impossible to avoid the conclusion that he has not always thought out his argument clearly. He holds that three factors, germinal constitution, environment and tradition, enter into the problem. The distinction drawn between environment and tradition is little more than formal, and it would be difficult as a practical matter to separate the two. While recognising the existence of mental differences arising out of differences of race, in Europe, for instance, he does not appear to have considered the bearing of differences of race upon the character of the population within a social organism such as that of this country, where further investigation may, and probably will, show that such differences are of more than academic interest, and have no inconsiderable importance in relation to a number of social problems. Mr. Carr-Saunders' final conclusion is, however, that "The course of history is in the main dependent upon changes in tradition. . . . . As far as tradition is equalised . . . to that degree is mental endowment of pre-eminent importance to the individual." With that message of hope to the reformer and the eugenist this notice may fittingly end.

E. N. Fallaize.

AN ENTHUSIASTIC MOUNTAINEER IN NEW ZEALAND.

The Conquest of the New Zealand Alps. By Samuel Turner, F.R.G.S. (T. Fisher-Unwin, 21s.).

Few climbers have had a wider experience of the summits of the world than Mr. Turner. Twenty-four years ago he began his climbing in the Swiss Alps. Since then he has never tired of the pastime, and has pursued it in the Alps, the Albai Mountains of Siberia, and New Zealand, with a tentative venture in South America on the slopes of Aconcagua. In the intervals of more serious work, Mr. Turner kept himself in practice by winter rock climbing in England and Wales, or by what seems to be the extraordinarily dreary exercise of skipping. We gather that he prides himself on holding the record for one hour's non-stop skipping, which entailed over 10,000 skips. Climbing has always been Mr. Turner's pastime, to which he has devoted himself in intervals between his business affairs, but it was only when he settled in New Zealand in 1911 that he could satisfy a longing to tackle the little known New Zealand Alps. The book records seven years' climbing, from 1912 to 1921. In each year the climbing season was fully occupied, and many victories were gained.

The summit of the New Zealand Alps is Mount Cook,

which has an altitude of 12,349 feet. There appear to be several routes to the summit, and the mountain was first climbed in 1894. Since then it has been ascended over twenty times. In recent years scarcely a season has been missed. But Mr. Turner was ambitious to achieve a single-handed ascent. Such a feat entailed some risk, but to Mr. Turner it promised a unique pleasure. "Twenty-four years' mountain exploration and climbing have made me exhaust nearly all the pleasures of the climbing craft, except solitary climbing. The virgin peaks climbed by me alone. . . . . are the outstanding features of all kinds of ascents of various degrees of difficulty on this globe during my climbing career." Six attempts in various years failed owing to unsuitable weather, but eventually Mr. Turner satisfied his ambition, and was so proud of his achievement that he not merely employed witnesses at a lower altitude to see him on the summit, but prints their certificate. Why trouble to prove what no one wishes to doubt, especially when the climb, according to Mr. Turner's own admission, was made to satisfy himself alone? As he says: "The real climber will climb even if there be only the mountain to witness the feat." Another good climb was that of Mount Tasman, the second greatest altitude in New Zealand, and only 874 feet lower than Mount Cook. It was, however, in his Mount Tutoko expedition in 1919 and 1920 that Mr. Turner broke the most interesting ground. There he was in a little known and imperfectly surveyed region, and succeeded in discovering a new lake as well as clearing up some doubtful details of the topography. He climbed to within a few hundred feet of the top of Mount Tutoko, and showed that this name which belongs to the highest peak in the district has not infrequently been wrongly attached to the somewhat lower Mount Madelaine.

The whole book will be of great interest to climbers from the detail the author gives to describing various difficult problems he encountered. A happier literary style would endow many of the situations with a thrill which they miss in the telling. The author's sentences are frequently awkward, and his style is apt to offend the reader. A careful revision would not have been amiss.

Mr. Turner rightly believes that New Zealand offers a fine field for the enthusiastic mountaineer, but weather conditions around the highest peaks are very uncertain. Snowfall, even at midsummer, is often heavy, and lies at about 2,000 feet. The peaks rise from relatively low levels, which necessitates quick travelling in order to take advantage of fine weather. December to February, and in some respects March, appear to be the best months for climbing. Some notes on the author's methods of training for his mountaineering are of interest. Mr. Turner, we gather, climbs for recreation, believing in a strenuous holiday in order to fit himself for business. He finds climbing keeps him young and fit, and we can well believe it when we read of some of the feats in which he rejoices. We have already noted the use of the skipping rope. A thousand skips in five minutes as a daily exercise, playing tennis in mountain boots (he says nothing of the court), Swedish exercise, wood-chopping, and the yearly ascent of certain peaks at a fixed speed, are all devices used by Mr. Turner. And to test his nerve, which seems never to fail him, he indulges in feats of balancing on lofty ridges and high summits, where the average man would feel well satisfied if he could merely stand upright. To a man so devoid of giddiness, mountaineering must indeed be a joy. Those who share this quality will find pleasure in the book. The illustrations are good.

R. N. Rudmose Brown.

Books Received

(Mention in this column does not necessarily preclude a review.)

MISCELLANEOUS SUBJECTS.

The Home of the Indo-Europeans. By Prof. H. H. Bender. (Princeton University Press, and Humphrey Milford, Oxford University Press, 4s. 6d.)

Greek Biology and Greek Medicine. By Charles Singer. (Oxford: At the Clarendon Press, 2s. 6d.)

The Book of Genesis. Translated into Colloquial English by Prof. T. H. Robinson, M.A., D.D. (National Adult School Union, 1s.)

Essays on the Depopulation of Melanesia. Edited by W. H. R. Rivers, M.D., F.R.S. (Cambridge University Press, 6s.)

The New Decameron. The Third Volume, containing stories by Compton Mackenzie, J. D. Beresford, D. H. Lawrence, etc. (Basil Blackwell, 7s. 6d.)

The Peoples of Europe. By Herbert John Fleure, D.Sc. (Oxford University Press, 2s. 6d.)

The World About Us. A study in Geographical Environment. By O. J. R. Howarth. (Oxford University Press, 2s. 6d.)

Short, carefully written, accurate, and up-to-date descriptions of these subjects, written by specialists for the non-specialist but serious student. Few books are so fresh and stimulating, as well as informing, and for the price, so well printed, as these. The inclusion of both a bibliography and an index would be a boon to readers. Prof. Fleure's book contains the former, and Mr. Howarth's the latter only.

SCIENCE.

The Discovery of the Circulation of the Blood. By Charles Singer, M.D., Litt.D., F.R.C.P. (Geo. Bell & Sons, 1s. 6d.)

This book is nicely printed and suitably illustrated, and has eighty pages in a stiff paper cover. It is the first of a new series entitled "Classics of Scientific Method," which promises to be a good one. The aim of the series

is to provide reproductions of the great masterpieces of science in a convenient form, together with a fairly complete account of the action and reaction of ideas which, through the process of time, led up to the crucial experiments carried out and described by some great master. This account by Dr. Charles Singer of Harvey's discovery of the circulation of the blood could hardly be bettered. His first chapter tells what the circulation of the blood is in the plain language of to-day; the second and later ones describe the knowledge of the vascular system in antiquity, and how the revival of learning and the early work of such men as Vesalius and Servetus led to Harvey's brilliant work early in the seventeenth century. The book is astonishingly interesting, partly, no doubt, because of its subject-matter, but partly also because it is written by an authority who knows and loves the subject he is describing. It is recommended whole-heartedly to our readers.

The Language of Anatomy. Tract No. IX. of the Society for Pure English. By Wm. Cuthbert Morton, C.B.E., M.A., M.D., and Robert Bridges, M.B., F.R.C.P. (Oxford: Clarendon Press, 2s. 6d.)

The gist of this paper by Dr. Morton and the Poet Laureate is to offer practical suggestions for the Englishing of the terminology of anatomical science. Its import is to condemn the action of those who are moving to introduce a formal Latin international terminology into the British Schools of Anatomy; it is argued that such action is wrong in principle and harmful in practice. The authors contend that all scientific nomenclature must have its basis in every national language, and that whatever classical or foreign terms are introduced should be as far as possible adapted to the national speech.

The Green Ray. By Prof. M. E. Mulder. (T. Fisher-Unwin, 6s.)

A monograph on the green ray or green flash seen, or, according to some, alleged to be seen, at the rising and the setting of the sun. Previous descriptions of this ray and opinions about it are discussed. The author is not dead sure of himself, but he favours the " dispersion " theory of its existence, and is against believing it to be an " after-image " phenomenon.

Chemistry for Beginners and Schools. By C. T. Kingzett, F.I.C., F.C.S. Fourth Edition. (Baillière, Tindall & Cox, 5s.)

La Notion d'Espace. By D. Nys, Professor in the University of Louvain. (Brussels: Les Editions Robert Sant; London: Humphrey Milford, 15s.)

Mechanics. Part I. By George Thompson and George H. Leslie, B.Sc. (Cassel & Co., Ltd., 2s.)

A new volume in a series which has been previously noticed.

The Report of the National Physical Laboratory for the Year 1921. (Sold by H.M. Stationery Office, 6s. 6d.)

THE WORLD'S LARGEST TELESCOPE AND ITS REVELATIONS.

The New Heavens. By George Ellery Hale. (Charles Scribner's Sons, 7s. 6d.)

The general reader, that indefatigable person for whom authors strive to write books and reviewers agonise to explain what they are about, will find Dr. Hale's book a revelation and a delight. It is a short book of eighty-eight pages containing in them no less than forty illustrations, most of them photographs of distinction, but every page is good. The author has a first-hand knowledge of his subject, for he is the director of the Mount Wilson Observatory (California) of the Carnegie Institution of Washington. And his method of treatment and style are excellent and well suited to the general reader; indeed, part of the book has already appeared in *Scribner's Magazine.*

The book has three chapters. The first contains a description of the 100-inch Hooker telescope—the largest telescope in the world—what it is, and what can be done with it; the second describes giant stars, and gives an account of the determination of the angular diameter of Betelgeuse by the interferometer method; the third is entitled Cosmic Crucibles, and deals with the enormous pressures and temperatures of certain stars and the relation of these to the building up of the heavier elements from lighter ones.

The photographs reproduced are excellent and instructive.

A. S. R.

Correspondence

RADIATIONS FROM SLOW RADIUM AND THEIR THERAPEUTIC VALUE.

To the Editor of Discovery.

Sir,

YOUR REVIEW.

The short notice which appeared in your Journal of May, 1922, page 139, has just been brought to my notice. It deals with an unfair and incorrect review of my book entitled:—

" Radiations from Slow Radium; by John B. Kramer; And their therapeutic value; by Major John F. Hall-Edwards, L.R.C.P. (Edin.), D.M.R.&E. (Cantab.), F.R.S. (Edin.), Hon. F.R.P.S., late R.A.M.C."

Your critic, when reviewing a book, might at least be accurate before he accuses anyone else of "inaccuracy." He quotes the title of my book—I should say, disingenuously—wrongly. Will you please correct this in your next issue?

Then he "throws mud"—without qualification: and "runs away"—anonymously.

His criticism is priceless, and his argument, that "Radium is Radium," exposes his logic. (I presume he means it does not matter how it is applied—strong or weak—quick or slow—as long as "Radium is Radium.")

As to his accusation that my book, "containing several very inaccurate descriptions of simple scientific facts"—I must at once say that he cannot prove one single statement in my book as being inaccurate.

I can only conclude that your critic does not understand the book, its purposes, and its value. He is of the opinion therefore that it should never have been written. (*Sic.*)

Will you permit me to inform him that among the numerous letters of satisfaction and congratulation I have received are many from eminent medical and scientific men, also that the theory I advocated has since been put to severe tests by medical men, who are pleased with the good results obtained. Reports will appear in due course in the Medical Press.

If, therefore, my suggested Treatment is right and apparent, men of your critic's calibre must evidently only possess a smattering knowledge of Radio-activity for Therapeutic purposes, and are, therefore, afraid to give their reasons for their "mud throwing."

A copy of this letter, together with a copy of the criticism in your May number (in case this letter is refused the hospitality of your Journal) will be sent by me to all those who have expressed themselves as pleased with my book, and also to all future readers.

I think it is time that such unscrupulous and incompetent criticism should be stopped or exposed.

Yours, etc.,

J. B. KRAMER.

WHEATSHEAF HOUSE,
WHEATSHEAF ROAD,
EDGBASTON.
5th July, 1922.

REPLY BY OUR REVIEWER.

SIR,

Let me take Mr. Kramer's points in turn.

(1.) The complaint about the title is neither justified nor important. There are three variants of it, one on the cover, which is the one I took and reproduced accurately, a second on the back of the book, a third on the title page. The one given in Mr. Kramer's letter above makes a fourth. It is a mis-quotation of that on the title page, which was not used, as it was too long.

(2.) I do not "throw mud without qualification." Part of my review was praise, part criticism. In some ways I thought the book a bad one and said so. The criticism was honest. I have a large experience in reading scientific books, and I may claim in all modesty that I know as much about Mr. Kramer's subject as he does.

(3.) Anonymity is not a crime. Short reviews in *Discovery* and many elsewhere are anonymous. To describe a custom as cowardice is absurd.

(4.) Mr. Kramer asks me to prove a single statement in his book as inaccurate. Easily done. On page 6 there are ten sentences, seven of which contain misstatements. He says there, for instance, that zirconium is a radio-element. Untrue. He says that the process of disintegration of the thorium atom lasts 6,000 years. Actually, the period of average life of thorium atoms is about 18,000,000,000 years! And so on. On page 5 he says: "If one could add or subtract a certain number of millions of electrons per atom, one element would be converted into another without more ado." No one who understands the subject talks about electrons in millions. From one to approximately a hundred is roughly the number. And the statement itself is not true. The chief point about converting one element into another is that the nucleus and not the attendant electrons must be altered. Again, although he describes it correctly elsewhere in the book, he says of radio-activity on page 5: "It means nothing else than the issue of the electrons from the womb of the atom." But it does. The most characteristic radiation from a radio-element is a particle which is not an electron, but a helium atom minus its electrons. In different parts of the book there are errors not trivial and excusable, but such that they reveal the author's ignorance of the subject he professes to write a book about.

(5.) I am not concerned with the complimentary reviews and letters Mr. Kramer has received. I should indeed be surprised if journals like *Nature* or *Science Progress* praise the book, but obviously a reviewer's job is to give his own opinion and not those of other people. The book appeared to me to be badly written and inaccurate from the scientific point of view, a rather weak and erroneous account of well-known facts. And I thought so, and still so think.

Yours, etc.,

A. S. RUSSELL.

THE PACIFIC BASIN AND AMERICAN CONTINENT.

To the Editor of DISCOVERY.

SIR,

With reference to the article by Prof. Wegener in the May number of *Discovery*, there is no mention of the theory of the breaking off of the Moon from what is now the Pacific Basin. This, if proved, would explain why there should be so little (comparatively) of the earth's outermost skin; and also the quicker movement of the Americas as compared to the rest, since, being nearest in the line of motion to the vacant space, the westernmost part of the continental mass would be most strongly attracted to fill it.

Yours, etc.,

P. T. ENGLISH.

MONTSERRAT,
B.W.I.
24th June, 1922.